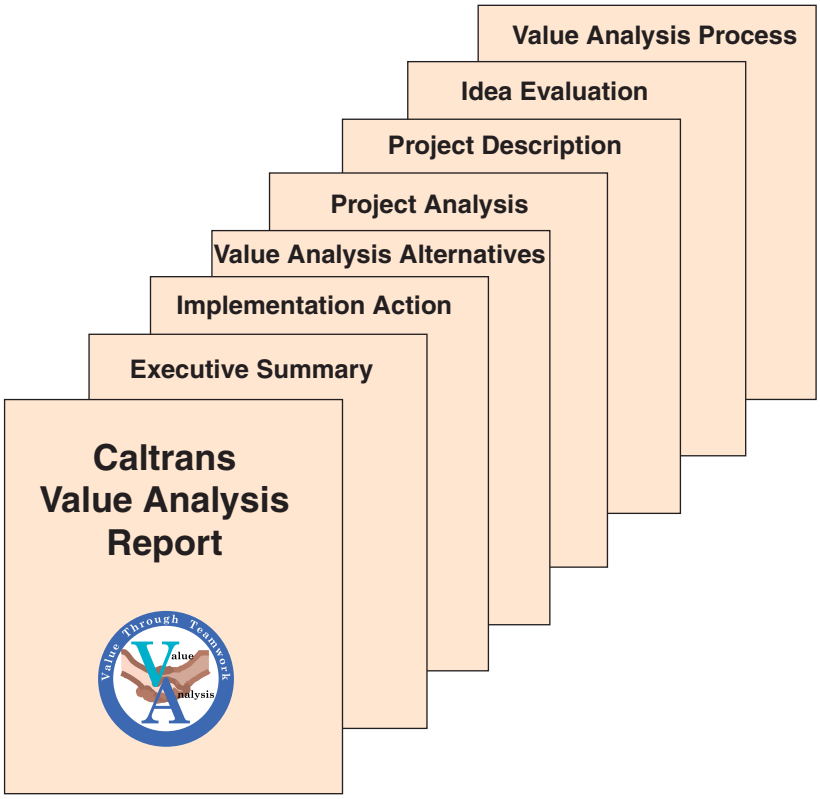
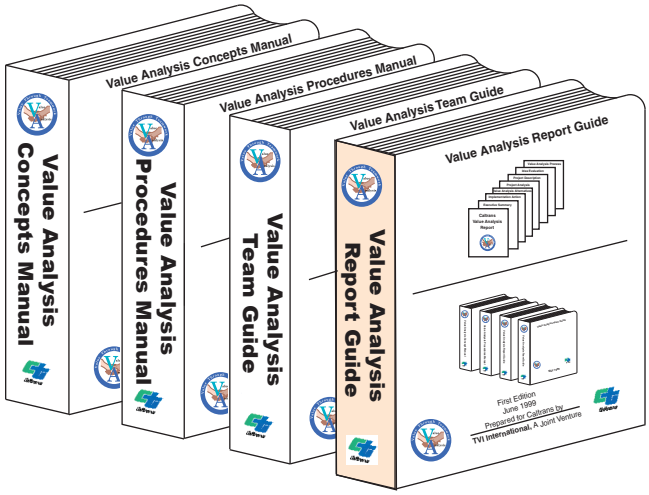
Value Analysis Report Guide





First Edition
June 1999

State of California Department of Transportation
Design and Local Programs
Value Analysis Branch

Prepared for Caltrans by

TVI International, A Joint Venture

State of California Business Transportation and Housing Agency

M e m o r a n d u m

To: District Value Analysis Coordinators **Date:** June 18, 1999

File: 303

From: **DEPARTMENT OF TRANSPORTATION**
Design and Local Programs
Mail Stop #28

Subject: VA Team Guide
VA Report Guide

The VA Branch is pleased to send you the first edition of the two referenced guides. These guides will assist the District VA team members in the execution of value analysis studies for highway construction projects. The two guides are:

VA Team Guide: The Team Guide is distributed to every VA team member participating in a study. It has all the forms, with instructions, needed to document the VA team activities and the individual VA alternatives.

VA Report Guide: The Report Guide provides instructions for completing the VA Study Report in order to consistently document the VA recommendations and activities for each and every VA study.

Please share these guides with all interested District personnel.

The next publication in this series will be the final draft of the VA Procedures Manual. The VA Procedures Manual details all the steps involved in the preparation, performance, and implementation of VA studies performed by the District Value Analysis Coordinator.

If you have any questions, please call George Hunter, VA Branch Chief, at ATSS 453-3538.

Sincerely,

Original signed by
Timothy Craggs, Chief
Office of State Project Development Procedures and Quality Improvements

Caltrans VA Report Guide, May 1999

Revisions made in this Edition of the VA Report Guide

1. **VA Standards Matrix** – updated with new and revised items
2. **VA Activity Chart** – revised to clarify implementation activities
3. **Study Identification form** – added new project identification information
4. **Evaluative Criteria Matrix** – renamed from Paired Comparison Matrix
5. **Creative Ideas Evaluation example** – expanded advantages and disadvantages
6. **Initial Costs form** – renamed from Cost Estimates form, clarified overheads
7. **Life Cycle Costs form** – improved for automatic calculations and reformatted
8. **Management Presentation Comments** – added new form and instructions
9. **Blank Forms** – updated to include the above name and format changes
10. **Examples** – numerous revisions to agree with above name and format changes
11. **Instruction text** – numerous clarifications and expansions of detailed instructions
12. **Front Cover** – changed graphic art
13. **Page Numbers** – renumbered sections independently
14. **Report Evaluation Form** – deleted form
15. **Section Contents** – added tables of contents for each section
16. **Foreword** – added reference to modifications to guide for "special" VA studies
17. **VA Program Overview section** – revised headings
18. **Report Organization section** – revised headings, reordered material, added draft cover letter, clarified distribution list instructions
19. **Report Evaluation form** – deleted entire form and instructions
20. **Executive Summary section** – renamed Project Issues from Concerns and Objectives, reordered material, added draft and final Abstract with instructions, added final Executive Summary instructions, clarified initial costs vs. life cycle costs
21. **Implementation Action section** – added final Implementation Action, Summary and Disposition and VA Alternative Implementation instructions, expanded implementation meeting comments, defined "conditionally accepted", added distinguishing between Initial Cost savings and Life Cycle Cost savings
22. **VA Alternatives section** – added distinguishing between Initial Cost savings and Life Cycle Cost savings
23. **Project Analysis section** – renamed matrix forms, corrected text, expanded FAST example
24. **Project Description section** – added project identifiers, revised Project Information instructions to conform to Team Guide

FOREWORD

The Caltrans Project Development Procedures Manual, in Chapter 19 – Value Analysis, states:

> *It is Caltrans' policy to apply Value Analysis (VA) in all functional areas, including project development, construction, traffic, operations and maintenance.*

This VA Report Guide is a tool to carry out that policy. It is for every Caltrans District VA team member and others who serve on VA teams. The Report Guide serves as a reference document for the VA methodology and as a detailed guide to the preparation of the documentation needed to report the results of a VA study. See the following VA Standards Matrix for other information on value analysis.

Each section of this Report Guide describes the steps to fill out the preprinted forms during the VA study and organizes all of the documentation to compile a clear and concise report that will communicate the findings of the VA study and facilitate implementation of the VA alternatives. This guide serves as a model for a "standard" VA report; modifications may be made to accommodate "special" VA studies.

All pages in this guide printed in Italics are specific instructions for the example documents on following pages. Blank forms for use by VA team members are provided at the end of the Report Guide.

Divider pages with tabs identify the sections of the standard report format. As new material becomes available from the VA Branch or the local District, it can be included here for future reference.

A VA Report Checklist is included (see pages 2.2-2.3) to use as a guide while preparing a report.

Caltrans Value Analysis Standards Matrix

Revised April 22, 1999

Topic	Item	VA Concepts	VA Team Guide	VA Report Guide	VA Procedures
	Users:	VA Team Members	VA Team Members	VA Team Leaders	VA Coordinators
	Function:	Learn VA Methodology	Execute VA Studies	Document VA Studies	Manage VA Studies
INTRO	Foreword	X	X	X	X
	Standards Matrix	X	X	X	X
	Program Overview	X	X	X	X
	Activity Chart	X	X	X	X
METHODOLOGY	Fundamentals/History	X			
	VA Job Plan	X	X	X	X
	Project Selection/Study Timing	X			X
	Information Phase	X	X		
	Function Analysis Phase	X	X		
	Creative Phase	X	X		
	Evaluation Phase	X	X		
	Development Phase	X	X		
	Presentation Phase	X	X		X
	Implementation Phase	X			X
	Audit Phase	X			X
	Paradigms/Constraints	X		X	
	Life Cycle Costs	X	X	X	X
TOOLS	Bibliography	X			
	Caltrans Manuals	X			
	Blank Forms	X	X	X	X
	Examples	X	X	X	X
STUDY MANAGEMENT	Time Requirements				X
	Team Selection	X			X
	Leader Selection	X			X
	Training/Certification	X			X
	Project Documents	X	X		X
	Schedule/Agenda	X			X
	Study Room/Support Facilities				X
	Support Facilities				X
	Preparation Meeting	X			X
	Assisting/Monitoring Teams				X
	Designer Briefing	X	X		X
	Team Presentation	X			X
	Report Preparation	X			X
	Selecting Alternatives	X			X
	Implementing Alternatives	X			X
	Study Evaluation Form				X
	VA Awards				X
	Managing District Program				X
REPORT PREPARATION	Report Organization	X		X	X
	Report Distribution			X	X
	Executive Summary	X		X	
	Implementation Action	X		X	
	VA Alternatives	X		X	
	Project Analysis	X		X	
	Project Description	X		X	
	Idea Evaluation	X		X	
	VA Process	X		X	
	Summary of Savings	X		X	
	Benefit-Cost Analysis	X		X	X
	Database Input	X			X
STUDY PERFORMANCE	Project Identification Form	X	X	X	
	VA Alternative Form	X	X	X	
	Sketches Form	X	X	X	
	Calculations Form	X	X	X	
	Benefits Form	X	X	X	
	Initial Costs Form	X	X	X	
	Life Cycle Costs Form	X	X	X	
	VA Design Suggest. Form	X	X	X	
	Alternative Summary Form	X	X	X	
	Cost Model Form	X	X	X	
	Functions Form	X	X	X	
	FAST Diagram Form	X	X	X	
	Cost-Function Matrix Form	X	X	X	
	Evaluative Criteria Form	X	X	X	
	Weighted Comparison Form	X	X		X
	Presentation Outline		X		
	Mgmt. Presentation Comments		X	X	

TABLE OF CONTENTS

VA Program Overview

CALTRANS VA POLICY

The Caltrans Project Development Procedures Manual (PDPM), Chapter 19 – Value Analysis, presents the policy and procedures to apply Value Analysis (VA) to highway construction projects and other activities of the department. The applications, roles and responsibilities and activities necessary to carry out a VA study are outlined. In summary, the PDPM covers the following topics in five sections:

1. Policy and benefits of value analysis
2. Criteria for District and Statewide VA studies
3. Roles and responsibilities of District and Headquarters personnel
4. VA job plan and pre-study, study and post-study activities
5. Scope and timing of VA studies

This VA Report Guide does not duplicate the material found in the PDPM. Rather, it augments the PDPM with detailed instructions and examples of documents to assist the VA team members to fulfill their assignments.

VA APPLICATIONS

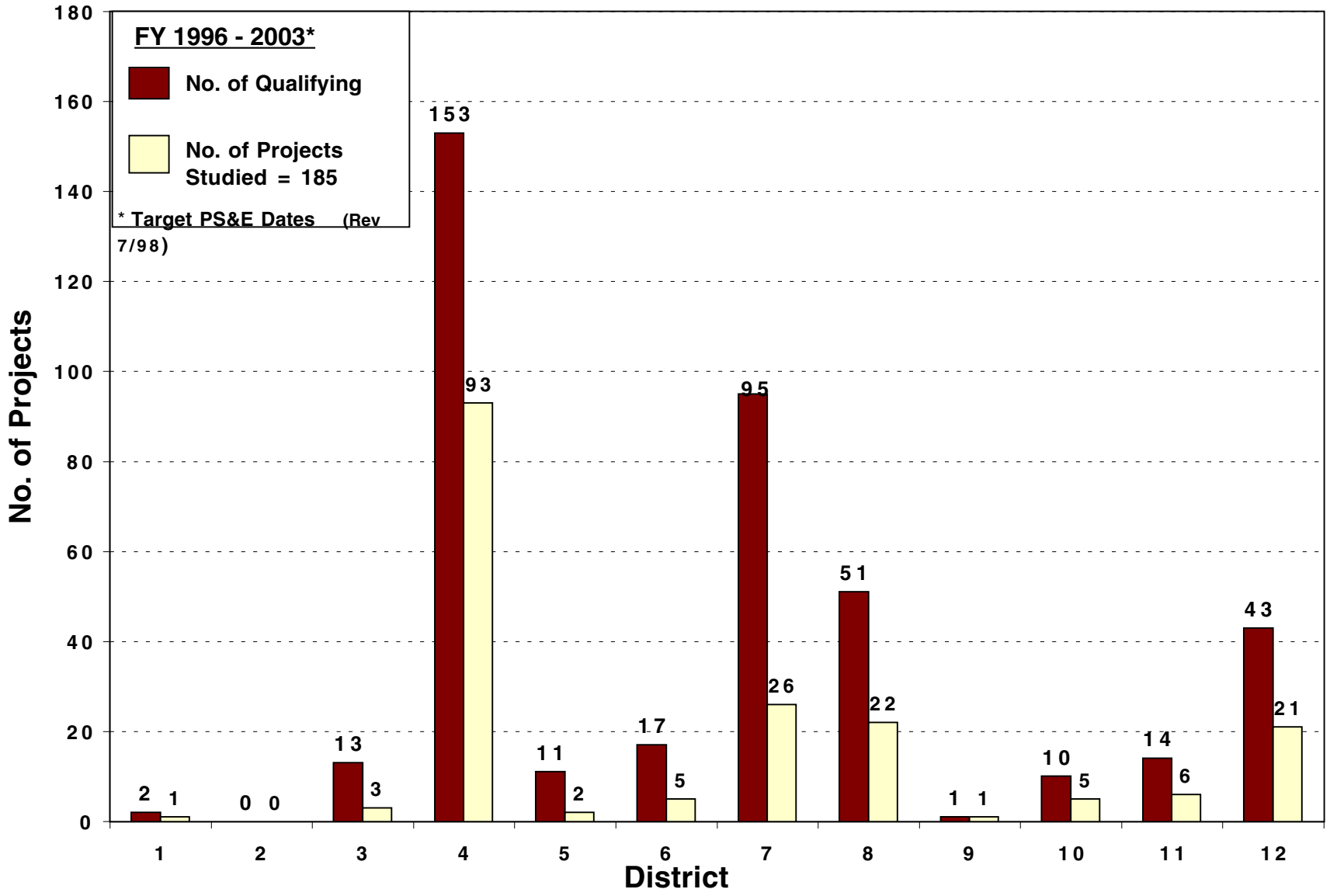
As stated in the PDPM, value analysis should be considered for "any State transportation projects developed by Caltrans, local agencies, consultants, or private developers that are estimated to cost over $1,000,000". Further, "any functional unit may initiate the VA process [on] an item or process with Statewide or District-wide implications." Examples of current VA applications are:

- **Highway Construction Projects.** The use of VA to improve the value of projects has been demonstrated in all Caltrans Districts since 1969. For example, the use of VA on the seismic retrofit programs in California has resulted in documented savings of more than $200,000,000, and was instrumental in the decision to construct a new east span of the San Francisco – Oakland Bay Bridge instead of seismically retrofitting the existing bridge.

- **National Highway System Act.** The NHS Act has increased the use of VA nationally and within Caltrans. Major highway improvement projects in the urban Districts have required an intensive effort by Caltrans and consultants to comply with the law. The following chart graphically shows the NHS-mandated VA studies completed in each District.

- **Caltrans Processes.** VA has been actively applied at both the District and Headquarters levels on business plans and traffic management plans, as well as research reports.

- **Caltrans Products.** VA has been applied in Caltrans to improve standard highway items, many of which are in the Standard Plans, such as glare screens, concrete barriers, highway sign structures, and many other items.


FY 1996 - 2003*
No. of Qualifying
No. of Projects Studied = 185
* Target PS&E Dates (Rev 7/98)
No. of Projects
District
180
160
140
120
100
80
60
40
20
0
1 2 3 4 5 6 7 8 9 10 11 12
2 1
0 0
13 3
153 93
11 2
17 5
95 26
51 22
1 1
10 5
14 6
43 21

VA ACTIVITY CHART

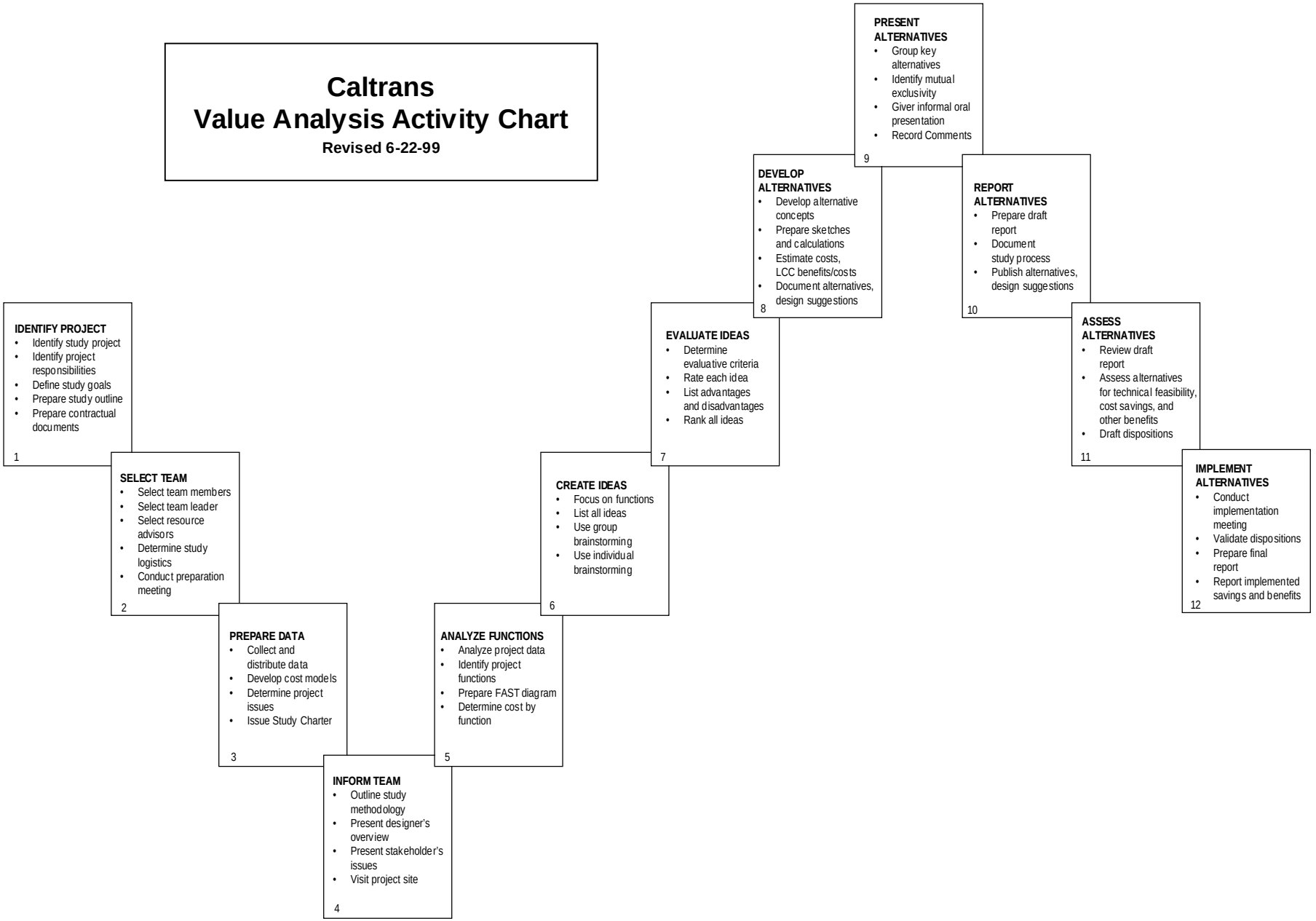
The VA Activity Chart on the following page summarizes the 12 steps required to successfully complete a VA study. It begins with *Identify Project* and ends with *Implement Alternatives.* The activities are grouped in three phases:

- **Pre-Study Preparation**
  - Identify Project
  - Select Team
  - Prepare Data
- **Study Performance**
  - Inform Team
  - Analyze Functions
  - Create Ideas
  - Evaluate Ideas
  - Develop Alternatives
  - Present Alternatives
- **Post-Study Implementation**
  - Report Alternatives
  - Assess Alternatives
  - Implement Alternatives

The VA Activity Chart serves as a guide to the VA Coordinator, the VA team, and team leader, as well as the stakeholders, all of whom are participants in VA studies.

This VA Report Guide focuses on the Report Alternatives Activity (Box 10). It describes how the team leader organizes all of the material generated during the study into a VA study report. The VA Team Guide (in a separate volume) outlines the steps to accomplish the Study Performance Activities (Boxes 4-9).

Caltrans
Value Analysis Activity Chart
Revised 6-22-99



Report Organization

VA REPORT CHECKLIST

The following checklist guides the VA team leader through all of the items contained in the VA study report. It is organized in the order of the printed report. However, it is helpful to complete the items in reverse order so that the Executive Summary is written last, after the balance of the report is completed.

Report Front Material

- ☩ Table of Contents
- ☩ Front Cover, Edge and Back Cover
- ☩ Divider Tabs
- ☩ Cover Letter
- ☩ Distribution List

Executive Summary

- ☩ Abstract
- ☩ Introduction with EA Number(s)
- ☩ Project Description Summary
- ☩ Project Issues
- ☩ Project Analysis Summary
- ☩ VA Alternatives
- ☩ Implementation Action
- ☩ Management Presentation Comments
- ☩ VA Team and Process Summary

Implementation Action

- ☩ Implementation Action
- ☩ Summary and Disposition Sheets
- ☩ VA Alternative Implementation Sheets

VA Alternatives

- ☩ Management Presentation Comments
- ☩ Summary of VA Alternatives
- ☩ VA Alternatives Documentation
- ☩ VA Design Suggestion Documentation

Project Analysis

- ☩ Project Analysis Summary
- ☩ Cost Model
- ☩ Function Analysis
- ☩ FAST Diagram
- ☩ Cost/Function Analysis
- ☩ Evaluative Criteria Matrix
- ☩ Weighted Comparison Matrix
- ☩ Highway User Life Cycle Benefit-Cost Analysis

Project Description

- Introduction
- Project Description
- Information List
- Key Drawings
- Project Information

Idea Evaluation

- Idea Evaluation
- Creative Ideas Evaluation Worksheets

Value Analysis Process

- Value Analysis Process
- Study Agenda
- Study Participants List
- Meeting Attendees

REPORT OUTLINE

The VA study report is prepared following each study in accordance with the standards outlined in this VA Report Guide. The team leader is primarily responsible for gathering the documentation generated during the study and compiling it systematically into a report to the project manager within one to two weeks following the study. The VA Team Guide is a comparison volume used to facilitate the development of documents prepared by the VA team.

The VA study report is organized in seven sections, preceded by a cover letter, distribution list, and report evaluation form:

- **Executive Summary** Providing an overview of the project and the VA alternatives
- **Implementation Action** Recording the final disposition of the VA alternatives
- **VA Alternatives** Documenting the individual VA alternatives and design suggestions
- **Project Analysis** Summarizing the findings of the value analysis of the project
- **Project Description** Reiteration of the project scope and cost
- **Idea Evaluation** Listing of all the creative ideas and their evaluations
- **Value Analysis Process** Summarizing the VA Job Plan, schedule and participants

Preparing a thorough VA study report is essential to communicate clearly the VA alternatives to the stakeholders and designer as the first step in their implementation.

The report is a transcription of the hand-written work of the VA team members, is kept in electronic and hard copies, and is bound in report documents for review by decision makers.

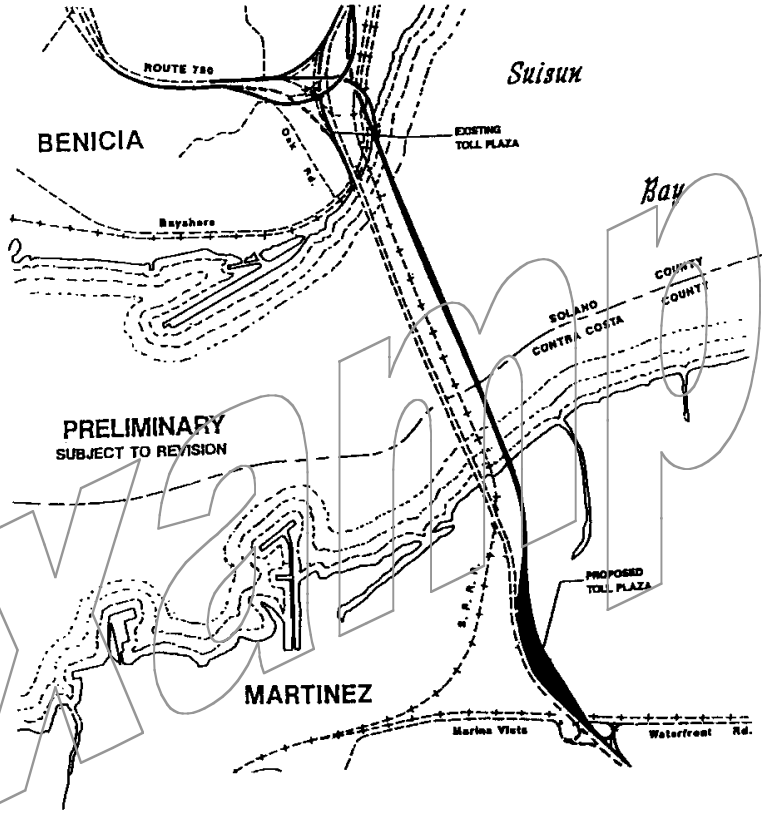
PRINTING AND BINDING

The VA study report is printed one-sided to accommodate the variety of technical information included in the VA alternatives. Binding in three-ring binders allows easy removal and replacement of individual pages. Preprinted divider tabs are used to separate the report sections.

Cover Pages. *The example cover pages for the report include:*

- ***Front, Edge and Back Covers*** *– Standardized format prepared by reporting organization, to identify study project, including project EA numbers*

Value Analysis Report



Benicia-Martinez Bridge Approaches

04-006051-CC-680-KP 38.5/39.9
04-006061-SOL-680/780-KP L0.5/R1.6 (680) 1.1/2.4 (780)

Contract No. 53A0005
Task Order No. 17

June 1998

Prepared by

TVI International, A Joint Venture

TVI International

Value Analysis Report

BENICIA-MARTINEZ BRIDGE APPROACHES

CALTRANS DISTRICT 4 - OAKLAND, CALIFORNIA

October 1998

TVI International, A Joint Venture

3520 Monte Real
Escondido, CA 92029-7910
(760) 741-1155 • Fax (760) 489-6765

2711 LBJ Freeway, Suite 1000
Dallas, TX 75234
(972) 484-9555 • Fax (972) 241-3677

COVER LETTER – DRAFT

A cover letter with a distribution list accompanies the VA Study Report, identifying the study project and specifying the names and/or departments receiving the draft/final report.

Draft Cover Letter. *The draft cover letter is a formal transmittal of the draft report to district VA Coordinator. It introduces the study project and requests a review of the VA alternatives. The letter for the final report summarizes the implementation results and identifies the pages being transmitted to update the draft report to the final report.*

DISTRIBUTION LIST

The distribution list accompanies the cover letter and identifies each recipient of the VA Study Report.

Distribution List. *The example distribution list directs draft/final VA Study Reports to the following:*

- *Project Design Team*
- *Functional Units*
- *Caltrans VA Team Members*
- *VA Coordinator*
- *District Management*
- *Consultant Team Members*
- *Headquarters VA Branch*
- *Local Agencies*
- *Any Other Interested Parties*

Caltrans

November 11, 1998

Mr. Hamid Khorram
Value Analysis Coordinator
California Department of Transportation - District 4
111 Grand Avenue
Oakland, CA 94612

Reference: Value Analysis Study—Caltrans Task Order No. 17
Benicia-Martinez Bridge Approaches

Dear Hamid:

TVI International is pleased to transmit 21 copies of our Draft Value Analysis Study Report for the referenced project. Please distribute them as indicated on the attached distribution list. We have distributed additional copies to the consultant VA team members and the Headquarters Branch.

This report summarizes the results and events of the study conducted June 22-26, 1998, in Oakland, California. Once Caltrans has had the opportunity to review the alternatives, please provide a written statement on your implementation process and the responses to each alternative. After we receive your comments, we will integrate them into the Implementation Action section of the report and reissue it as the Final Value Analysis Study Report.

Also, please have readers of the draft report complete the report evaluation form (attached) so that we can obtain feedback to help improve future VA reports.

Sincerely,

TVI International

Roger B Sperling

Roger B Sperling, CVS

VA Study Report
Benicia-Martinez Bridge Approaches
Distribution List

PDT Team (7 copies)

1. Bijan Sartipi
2. Dennis Bosler
3. Duat Nguyen
4. Gersy Modesto
5. Ron Kiaaina
6. Stuart Goodson
7. File

Functional Units (10 copies)

1. Traffic
2. Highway Operations
3. Electrical
4. Maintenance
5. Hydraulics
6. Geotechnical
7. Right-of-Way
8. Environmental
9. File
10. File

Construction Department (2 copies)
Structural Construction (2 copies)
Structural Design (2 copies)
City of San Francisco (3 copies)

Caltrans VA Team (6 copies)

1. Paul Ward
2. Martin Pohll
3. Jack Kwei
4. Rob Shackelford
5. Ed Der
6. Fred Elenbaas

VA Coordinator (2 copies)

District Division Chief-Design West (1 copy)

1. Robert Baxter

Consultant Team Members*

1. Heidi Ouren*
2. Dean Marachi*

Headquarters VA Branch*

1. George Hunter*
2. Ron Richards*

*Distributed by Team Leader

COVER LETTER – FINAL

The final cover letter, with the same distribution list used with the draft cover letter, accompanies the revised pages of the Final VA Study Report.

Final Cover Letter. *The example final cover letter is a formal transmittal of the revised report pages needed to update the draft report to the final report. The letter lists the pages to be distributed to holders of the draft reports.*

TVI International

June 2, 1998

Mr. Hamid Khorram
Value Analysis Coordinator
California Department of Transportation - District 4
111 Grand Avenue
Oakland, CA 94612

Reference: Value Analysis Study—Caltrans Task Order No. 6
I-880/SR-262 Interchange and Road Widening

Dear Hamid:

TVI International is pleased to transmit 15 copies of selected final Value Analysis Study Report pages for the referenced project. One copy has been sent to Ron Richards in Sacramento. This report summarizes the events of the study conducted March 23-27, 1998, in Oakland, California, and incorporates the implementation comments dated May 22, 1998.

The following pages should be replaced in your draft report copies to make them final reports:

- Executive Summary (complete, 3 pages)
- Implementation Action (complete with tables and detailed comments, 14 pages)
- Color sketch, Alternative IA-12, Page 3 of 5

The following pages should be added to your draft report:

- Color sketch, RC-18, Page 3a of 9
- Paired Comparison Matrix – follows page 7.1, Idea Evaluation text

We enjoyed working with you and are looking forward to continuing our efforts to assist Caltrans in its value analysis efforts.

Sincerely,

TVI International

Roger B Sperling

Roger B Sperling, CVS

cc: Ron Richards

3520 Monte Real, Escondido, CA 92029-7910
phone (760) 741-1155 ◆ fax (760) 489-6765

2711 LBJ Freeway, Suite 1000, Dallas, TX 75234
phone (972) 484-9555 ◆ fax (972) 241-3677

TABLE OF CONTENTS

The Table of Contents tabulates all of the material in the report by major section and subsections.

Table of Contents. *The example Table of Contents lists all report sections and sub-sections contained in the report in the sequence presented. No page numbers are given because the VA alternatives are individually paginated; however, each section of text is page numbered.*

TABLE OF CONTENTS

6. PROJECT DESCRIPTION

Introduction
Project Description
Documents Provided to the VA Team
Key Drawings

7. IDEA EVALUATION

Introduction
Key Evaluative Criteria
Evaluation Process
Creative Ideas Evaluation Worksheets

8. VALUE ANALYSIS PROCESS

General
Pre-Study Preparation
VA Study
Post-Study Procedures
Agenda
VA Study Participants
Meeting Attendees

Executive Summary

ABSTRACT - DRAFT

The Draft Abstract presents a forward-looking view of the alternatives and their potential impact on the project. It is a brief, half-page summary of the project scope and cost, and the VA team's choice of alternatives to be implemented. It allows the reader to understand the study project and the technical scope and potential savings of the VA alternatives. A well-written abstract is not a "cut and paste" of other report material, but rather a careful rewording of the salient features of the VA report.

Draft Abstract. *The example Draft Abstract includes:*

- ***Project Description*** *– One or two sentences summarizing project scope and cost*
- ***VA Alternatives*** *– Summary of the key alternatives the VA team felt had the most potential to benefit the project and their potential savings. Distinguish between initial cost and life cycle cost savings*
- ***Management Comments*** *– Summary of management responses to the VA team's presentation of the alternatives*

ABSTRACT

DRAFT

The $127,900,000 Benicia-Martinez Bridge Approaches Project, along with a new main span, constructs a second highway across the Carquinez Strait (I-680). The VA study developed 13 alternatives for improvement with potential initial cost savings in excess of $25,000,000. Key south approach alternatives are realigning and redesigning the new Mococo Bridge structure, and reconfiguring the toll plaza; key north approach alternatives are reducing the number of levels of the interchange (left off to I780), extending the main span to land, and finding on-site fill locations. Management agreed that the VA team had identified many creative options. The project design team will review the alternatives as well as the 27 design suggestions for implementation; considering the fact that the main span design is 90% complete, some of these alternatives may be too late to yield significant savings.

ABSTRACT - FINAL

The Final Abstract gives a backward-looking view of the study, reporting on the implemented alternatives and accepted savings.

Final Abstract. *The example Final Abstract shows changes to the Draft Abstract as follows:*

- ***VA Alternatives*** *– Summary of implemented alternatives and accepted savings, in place of the potential savings.*

ABSTRACT

FINAL

The $127,900,000 Benicia-Martinez Bridge Approaches Project, along with a new main span, constructs a second highway across the Carquinez Strait (I-680). The VA study developed 13 alternatives for improvement with potential initial cost savings in excess of $25,000,000. The Project Design Team evaluated these alternatives and accepted four for implementation, a total savings of $16,533,000 (12.9%).

The implemented alternatives and their accepted savings are:

1.1	Reduce number of levels at north approach (left off to I-780)	$10,000,000
2.1	Find on-site fill locations	$776,000
3.1	Maximize bulb tees at Mococo structure	$1,605,000
4.0	Realign Mococo structure to east	$4,152,000

Ten of the 27 design suggestions also were accepted.

EXECUTIVE SUMMARY – DRAFT

The Executive Summary is a concise overview of the VA study process and results. It is divided into eight headings and focuses on the major issues for the project and the significant alternatives developed by the VA team. It is short enough, three to four pages, to allow for easy reader comprehension; but it is long enough to present a comprehensive summary of the key findings of the VA study. A well-written Executive Summary makes use of other report material that has been carefully edited to present the most important aspects of the VA study.

The example Draft Executive Summary models the reporting of an overview of the VA process and the results of the study.

Introduction. *The opening paragraph briefly summarizes the scope of the VA study:*

- ***Project Identification*** *– Project Name and Expense Authorization (EA) numbers:*
  04 - 006051 - CC - 680 - KP38.5/39.9
  (District) (EA) (County) (Route) (KP or PM)
- ***Designer and Project Documentation*** *– Type and source of documents*
- ***Responsible Team Leader*** *– VA team leader and organization*

Project Description. *The project description is condensed to a single paragraph:*

- ***Project Scope*** *– Essential features ; highways, structures, right of way*
- ***Project Schedule*** *– Programmed completion dates*
- ***Project Cost*** *– Estimated construction cost, including right-of-way utilities*

Project Issues. *The significant project concerns and objectives that guided the VA study are stated concisely:*

- ***Stakeholder's objectives for the VA study*** *– Targets of opportunity for VA team*
- ***Designer's concerns about the project*** *– Unresolved issues for VA team consideration*
- ***VA team's concerns about the project*** *– from their initial review*

Project Analysis. *A summary of the results gained from the use of the value analysis techniques on the project:*

- ***Cost Model*** *– High cost elements*
- ***Function Analysis / FAST Diagram*** *– Basic functions*
- ***Cost Function Analysis*** *– Cost drivers*
- ***Paired Comparison*** *– Weighted evaluative criteria*
- ***Weighted Evaluation Matrix*** *– Value ratios of competing alternatives*
- ***Life-Cycle Benefit-Cost Analysis*** *– Benefit/cost ratio*

VA Alternatives. *The most significant VA alternatives identified by the VA team as having the highest likelihood of improving the project are summarized in short paragraphs:*

- ***Number and title***
- ***Alternative concept compared to original concept***
- ***Advantages and disadvantages***
- ***Potential cost savings***

Management Presentation Comments. *Brief summary of comments by Caltrans' managers and other stakeholders participating in the study and in the VA team's presentation.*

VA Team and Process. *Summary of the study process and the participants:*

- ***Study Time and Place*** *– Study locale and schedule*
- ***VA Team Members*** *– Names, disciplines, affiliations*
- ***VA Process Overview*** *– Brief summary of process*

EXECUTIVE SUMMARY

DRAFT

INTRODUCTION

This Value Analysis (VA) Report summarizes the events of the VA study conducted for Caltrans District 4 by TVI International. The subject of the study was the Benicia-Martinez Bridge Approaches in Solano and Contra Costa Counties, California:

- 04-006051-CC-680-KP 38.5/39.9
- 04-006061-SOL-680/780-KP L0.5/R1.6 (680) 1.1/2.4 (780)

The documents provided to the VA team included the project report, preliminary project plans and cost estimates, and other technical data prepared by Caltrans.

PROJECT DESCRIPTION

The Benicia-Martinez Bridge Project constructs a second highway bridge across the Carquinez Strait east of the existing Benicia-Martinez Bridge, Union Pacific Railroad Bridge, and a pipeline corridor. The project also includes the construction of a new toll plaza facility, the reconstruction of the I-680/I-780 Interchange and portions of the I-680/Marina Vista Interchange, provisions for bicycles and pedestrians, accommodation for a future rail transit facility, and the necessary connections to the existing approaches. The current cost is estimated at $300,969,000, which includes $285,220,000 for construction and $15,749,000 for right-of-way and utility relocation. The bridge approaches are estimated at $127,900,000.

PROJECT ISSUES

The design team expressed several concerns and objectives to help guide the VA team's study of the project. The high cost of the flared Mococo structure and its environmental impact need review. A scheme to balance the earthwork and the use of fill in place of structures should be developed further. Changes to the new toll plaza should be avoided, and construction staging needs more analysis.

PROJECT ANALYSIS

The VA tools were used by the VA team to analyze the project. The cost model showed the highest cost item is the Mococo structure; the FAST diagram is based on the basic function of *Improve Congestion*. The highest cost function is *Connect Bridge-South* at 26% of the total cost. The weighted evaluation matrix showed the potential for improvement of both function and cost of the VA alternatives. The benefit-cost analysis calculates a Benefit / Cost ratio of 0.890 for the original concept and 1.042 for the VA concept.

VA ALTERNATIVES

The VA team developed 13 alternatives for improvement to the project. All of these alternatives will reduce construction cost; many of them also will improve functionality. Twenty-seven design suggestions were also prepared. Summary lists of the VA alternatives and design suggestions follow; descriptions of the eight key VA alternatives are given below:

- **Maximize Bulb Tees at Mococo (3.1).** Building the Mococo structure using eight spans of bulb tees eliminates substructure and saves an estimated $1,605,000.

- **Realign Mococo New Overhang Bridge to East (4.0).** Moving the alignment of the Mococo overhang eliminates the second stage of construction and reduces the flare. It saves time as well as cost ($4,152,000). Additional right-of-way and environmental mitigation costs do not appear to be significant.

- **Move Toll Plaza on South Side Slightly North (5.0).** By moving the new toll plaza slightly to the north (approximately 100 meters), the construction of the Mococo structure is simplified (reduced flare). The estimated cost savings are $2,556,000; there is also a significant reduction in the construction schedule.

- **Use Mechanically-Stabilized Earth Walls at South Approach (6.0).** Replacing Frame 4 in the box-girder structure at the south approach with MSE walls will contain the embankment without impacting the existing water treatment facility, for a cost savings of $4,435,000.

- **Reduce the Number of Levels in the North Approach Interchange (1.1).** There are four levels in the north approach interchange original design. Shortening Structures 1, 5 and 6 by decreasing the alignment profiles reduces schedule and cost by $12,271,000. In addition, over-water construction can be included in the main span contract. The left transition from I-680 to the start of I-780 (not an intersection) requires review.

- **Realign EN Line I-780 to I-680 at North Approach Interchange (1.2).** Realigning the EB I-780 to NB I-680 connector northward increases the radius and shortens the structure by half, reducing right-of-way and roadwork. I-780 still merges on the right at I-680 and the potential savings are $7,020,000.

- **Extend Main Bridge to Land at North Side and Allow Left Exit to I-780 (1.3).** The main bridge contract does not build all of the over-water spans. Shifting the over-water work from the interchange contract to the bridge contract and allowing a left transition to the start of I-780 (not an intersection) simplifies construction. The net savings are $1,675,000.

- **Find On-Site Fill Locations to Eliminate Export (2.1).** This alternative identifies potential on-site fill locations in a scheme to balance the earthwork for the north approach. Contour grading within the interchange saves $776,000.

Detailed documentation of these key alternatives, as well as the remaining ones not described above, is in the Study Results Section of this report.

MANAGEMENT PRESENTATION COMMENTS

On Friday, June 26, 1998, the VA team presented their findings to Caltrans District 4 managers and members of the Caltrans design teams. Key comments from that meeting were:

- Changing to a "left off" to I-780 violates the standard "right off" rule. Will study the alternative.
- The alternative to move the Mococo Bridge to the east will also reduce the amount of work required on the existing bridge. The impact on the on-ramps is not a big issue.
- While the realignment of N 680 to W 780 line affects the future light rail alignment, it is still possible to have the light rail in the median of I-680.

VA TEAM AND PROCESS

The five-day study was performed during the period of June 22-26, 1998, at the Caltrans District 4 Conference Room in Oakland, California. The VA study was led by Roger B Sperling, CVS, from TVI International. The VA team members are listed below:

Roger Sperling, CVS	Team Leader	TVI International
Paul Silvestri	Constructibility	National Constructors Group
Ed McNinch	Construction	LKM Engineering
Vince Gastoni	Bridge Engineer	Caltrans/ESC/OSD
Tim Dunne	Geotechnical	Fugro
Steve Whipple	Construction	Caltrans Toll Program
David Ambuehl	Construction	Caltrans Toll Program
Steve Mellon	Bridge Engineer	Quincy Engineering
Charles Smith	Environmental	Caltrans/Environmental
Ueche Chris Okpalaugo	Transportation Engineer	Caltrans Traffic Operations
Peter Lee	Agency Representative	MTC/Bay Area Toll Authority
Elizabeth Wiecha	Project Manager	Caltrans Toll Bridge Program

The VA Job Plan was followed to analyze the functions of the project, create and evaluate ideas for change, and develop and present alternatives to the project team. The study concluded with an informal presentation of the VA alternatives and design suggestions.

EXECUTIVE SUMMARY – FINAL

The Executive Summary is modified to become the Final Executive summary following the completion of the implementation meeting to document the final results of the study. A new section, Implementation Action, is added.

Final Executive Summary. *The example Final Executive Summary shows changes made to the following sections:*

- ***VA Alternatives:*** *Notations of which of the alternatives were implemented and the resulting savings of each.*
- ***Implementation Action:*** *A summary of the implementation dispositions and the total implemented savings.*

EXECUTIVE SUMMARY

FINAL

INTRODUCTION

This Value Analysis (VA) Report summarizes the events of the VA study conducted for Caltrans District 4 by TVI International. The subject of the study was the Benicia-Martinez Bridge Approaches in Solano and Contra Costa Counties, California:

- 04-006051-CC-680-KP 38.5/39.9
- 04-006061-SOL-680/780-KP L0.5/R1.6 (680) 1.1/2.4 (780)

The documents provided to the VA team included the project report, preliminary project plans and cost estimates, and other technical data prepared by Caltrans.

PROJECT DESCRIPTION

The Benicia-Martinez Bridge Project constructs a second highway bridge across the Carquinez Strait east of the existing Benicia-Martinez Bridge, Union Pacific Railroad Bridge, and a pipeline corridor. The project also includes the construction of a new toll plaza facility, the reconstruction of the I-680/I-780 Interchange and portions of the I-680/Marina Vista Interchange, provisions for bicycles and pedestrians, accommodation for a future rail transit facility, and the necessary connections to the existing approaches. The current cost is estimated at $300,969,000, which includes $285,220,000 for construction and $15,749,000 for right-of-way and utility relocation. The bridge approaches are estimated at $127,900,000.

PROJECT ISSUES

The design team expressed several concerns and objectives to help guide the VA team's study of the project. The high cost of the flared Mococo structure and its environmental impact need review. A scheme to balance the earthwork and the use of fill in place of structures should be developed further. Changes to the new toll plaza should be avoided, and construction staging needs more analysis.

PROJECT ANALYSIS

The VA tools were used by the VA team to analyze the project. The cost model showed the highest cost item is the Mococo structure; the FAST diagram is based on the basic function of *Improve Congestion*. The highest cost function is *Connect Bridge-South* at 26% of the total cost. The weighted evaluation matrix showed the potential for improvement of both function and cost of the VA alternatives. The benefit-cost analysis calculates a Benefit / Cost ratio of 0.890 for the original concept and 1.042 for the VA concept.

VA ALTERNATIVES

The VA team developed 13 alternatives for improvement to the project. All of these alternatives will reduce construction cost; many of them also will improve functionality. Twenty-seven design suggestions were also prepared. Summary lists of the VA alternatives and design suggestions follow; descriptions of the eight key VA alternatives are given below:

- **Maximize Bulb Tees at Mococo (CBS-2).** Building the Mococo structure using eight spans of bulb tees eliminates substructure and saves an estimated $1,605,000.

  This alternative was implemented for $1,605,000 savings.

- **Realign Mococo New Overhang Bridge to East (CBS-5).** Moving the alignment of the Mococo overhang eliminates the second stage of construction and reduces the flare. It saves time as well as cost ($4,152,000). Additional right-of-way and environmental mitigation costs do not appear to be significant.

  This alternative was implemented for $4,152,000 savings.

- **Move Toll Plaza on South Side Slightly North (CBS-6).** By moving the new toll plaza slightly to the north (approximately 100 meters), the construction of the Mococo structure is simplified (reduced flare). The estimated cost savings are $2,556,000; there is also a significant reduction in the construction schedule.

- **Use Mechanically-Stabilized Earth Walls at South Approach (CBS-16).** Replacing Frame 4 in the box-girder structure at the south approach with MSE walls will contain the embankment without impacting the existing water treatment facility, for a cost savings of $4,435,000.

- **Reduce the Number of Levels in the North Approach Interchange (CBN-5).** There are four levels in the north approach interchange original design. Shortening Structures 1, 5 and 6 by decreasing the alignment profiles reduces schedule and cost by $12,271,000. In addition, over-water construction can be included in the main span contract. The left transition from I-680 to the start of I-780 (not an intersection) requires review.

  This alternative was implemented for $10,000,000 savings.

- **Realign EN Line I-780 to I-680 at North Approach Interchange (CBN-7).** Realigning the EB I-780 to NB I-680 connector northward increases the radius and shortens the structure by half, reducing right-of-way and roadwork. I-780 still merges on the right at I-680 and the potential savings are $7,020,000.

- **Extend Main Bridge to Land at North Side and Allow Left Exit to I-780 (CBN-8).** The main bridge contract does not build all of the over-water spans. Shifting the over-water work from the interchange contract to the bridge contract and allowing a left transition to the start of I-780 (not an intersection) simplifies construction. The net savings are $1,675,000.

- **Find On-Site Fill Locations to Eliminate Export (CBN-14.1).** This alternative identifies potential on-site fill locations in a scheme to balance the earthwork for the north approach. Contour grading within the interchange saves $776,000.

  This alternative was implemented for $776,000 savings.

Detailed documentation of these key alternatives, as well as the remaining ones not described above, is in the Study Results Section of this report.

IMPLEMENTATION ACTION

The project development team reviewed all of the VA alternatives and design suggestions. As noted above, four alternatives were implemented (CBN-5, CBN-14.1, CBS-2, and CBS-5) for a total implemented savings of $16,533,000. This is a 13% savings from the original $127,900,000 cost of the Benicia-Martinez Bridge Approaches project.

MANAGEMENT PRESENTATION COMMENTS

On Friday, June 26, 1998, the VA team presented their findings to Caltrans District 4 managers and members of the Caltrans design teams. Key comments from that meeting were:

- Changing to a "left off" to I-780 violates the standard "right off" rule. Will study the alternative.
- The alternative to move the Mococo Bridge to the east will also reduce the amount of work required on the existing bridge. The impact on the on-ramps is not a big issue.
- While the realignment of N 680 to W 780 line affects the future light rail alignment, it is still possible to have the light rail in the median of I-680.

VA TEAM AND PROCESS

The five-day study was performed during the period of June 22-26, 1998, at the Caltrans District 4 Conference Room in Oakland, California. The VA study was led by Roger B Sperling, CVS, from TVI International. The VA team members are listed below:

Roger Sperling, CVS	Team Leader	TVI International
Paul Silvestri	Constructibility	National Constructors Group
Ed McNinch	Construction	LKM Engineering
Vince Gastoni	Bridge Engineer	Caltrans/ESC/OSD
Tim Dunne	Geotechnical	Fugro
Steve Whipple	Construction	Caltrans Toll Program
David Ambuehl	Construction	Caltrans Toll Program
Steve Mellon	Bridge Engineer	Quincy Engineering

The VA Job Plan was followed to analyze the functions of the project, create and evaluate ideas for change, and develop and present alternatives to the project team. The study concluded with an informal presentation of the VA alternatives and design suggestions.

Implementation Action

IMPLEMENTATION ACTION – DRAFT

The Implementation Action section of the report provides a separate place to record the results of the implementation process. The draft report is read and reviewed by the decision makers and implementation decisions are made. An implementation meeting is held to reach consensus on the disposition of the alternatives and the final implementation decisions are recorded here when the final VA report is published.

The Draft Implementation Action section explains the general process that the decision makers follow to implement the VA alternatives.

Introduction. *Explains that the draft report contains Summary Disposition Sheets and blank VA Alternative Implementation Action forms that are to be used during the implementation of the VA alternatives*

Implementation Plan and Responsibilities. *Instructs the stakeholders and designer to reach consensus on the disposition of the VA alternatives. Names of persons attending the implementation meeting are requested and an implementation procedure is outlined.*

Implementation Action. *In the draft report, the list of implemented alternatives is omitted.*

IMPLEMENTATION ACTION

DRAFT

INTRODUCTION

The results of the VA study contained in the draft report are reviewed for implementation by the stakeholders and design team. The following Summary Disposition Sheets list all of the VA alternatives and design suggestions developed by the VA team. VA Alternative Implementation forms are used to record the disposition of each item; the information is incorporated in the final report as a complete record of the VA study.

IMPLEMENTATION PLAN AND RESPONSIBILITIES

When the Caltrans Project Development Team (PDT) and other stakeholders receive the Draft VA Study Report, they are asked to review the VA alternatives and render decisions regarding their implementation and financial (and non-financial) impacts on the project. VA Alternative Implementation forms are included at the end of this section with the title and number of each alternative; the PDT is requested to use these forms to record their assessment of each alternative, using the appropriate topics on the form.

After the initial assessments are completed, an implementation meeting is held with representatives of the PDT, the District VA Coordinator, the VA Team Leader, and other stakeholders. This meeting is facilitated by the VA Team Leader to reach consensus on the disposition of each alternative (as well as the design suggestions). The implementation dispositions (as previously noted on the implementation forms) are validated in this meeting. The signed forms are transcribed and included in the final report. The implementation results, noted on the Summary of VA Alternative tables, are included in the Executive Summary to complete the Final VA Study Report.

IMPLEMENTATION ACTION – FINAL

The draft Implementation Action section is modified to document the names of the implementation team and the dispositions of each alternative in the final report. The summary tables and implementation forms are also transcribed to form a complete record of the VA study through the implementation phase.

Final Implementation Action. *The example Final Implementation Action section shows changes made to the following sections:*

- ***Implementation Plan and Responsibilities:*** *The implementation process is summarized*
- ***Implementation Meeting:*** *Minutes of the Implementation Meeting are summarized.*
- ***Implementation Action:*** *The alternatives to be implemented are summarized.*

IMPLEMENTATION ACTION

FINAL

INTRODUCTION

The results of the VA study contained in the final VA report were reviewed for implementation by the stakeholders and design team. The following Summary Disposition Sheets list all of the VA alternatives and design suggestions developed by the VA team. The disposition of each item is noted and the implemented savings are recorded.

IMPLEMENTATION PLAN AND RESPONSIBILITIES

The implementation plan and responsibilities developed by the stakeholders and design team included meetings with the Project Development Team, District VA Coordinator, VA Team Leader, and other stakeholders, to evaluate the feasibility of the VA alternatives and to validate the cost savings. In some cases stakeholders, such as the City of Benicia, were consulted to obtain local approval of an alternative (see 1.1).

IMPLEMENTATION MEETING

An initial meeting with the project engineer, the District VA Coordinator, and the VA team leader reviewed the VA alternatives. However, some alternatives were still being studied, so a second meeting with the project manager was needed to determine final implementation actions.

IMPLEMENTATION ACTION

The four implemented alternatives for the Benicia-Martinez Bridge Approaches project are:

♦ 1.1	Reduce Levels in North Interchange	$10,000,000
♦ 2.1	Find On-Site Fill Locations to Eliminate Export	$776,000
♦ 3.2	Maximize Bulb Tees at Mococo	$1,605,000
♦ 4.0	Realign New Mococo Overhang Bridge to East	$ 4,152,000
	Total:	$16,533,000

SUMMARY AND DISPOSITION OF VA ALTERNATIVES – DRAFT

Each VA alternative is listed with the present value potential savings along with the design suggestions. Space is provided in the draft report for the disposition so that the stakeholders and designer can record their decisions reached in implementation meetings. These forms are completed with final disposition of the alternatives and the design suggestions and included in the final VA report.

Draft Summary and Disposition of Alternatives. *The example draft Summary and Disposition of VA Alternatives shows:*

- ***Alternative Number*** *– Decimal-numeric designator for the alternative*
- ***Title*** *– The title of the alternative*
- ***Potential Savings*** *– The present value of potential cost savings in the draft report. Distinguish between initial cost savings and life cycle savings (LCC following number)*
- ***Implemented Savings*** *– Left blank in draft report; added in final report*
- ***Disposition*** *– Left blank in draft report; completed in final report:*
  - ***A*** **=** ***Accepted*** *– will be incorporated into the design*
  - ***CA*** **=** ***Conditionally Accepted*** *– will be studied further to validate the technical feasibility and/or the potential cost savings; or, acceptance may be dependent on the environmental document or other project decision document*
  - ***R*** **=** ***Rejected*** *– will not be considered further*
- ***Comments*** *– Left blank in draft report*

SUMMARY OF VA ALTERNATIVES

Benicia-Martinez Bridge Approaches

DRAFT

Caltrans

Value Analysis Alternatives

Alternative Number	Title	Potential Savings*	Implemented Savings	Disposition	Comments
	CONNECT BRIDGE NORTH				
1.1	Reduce Levels in North Interchange	$12,271,000			
1.2	Realign FN Line at North End	$7,020,000			
1.3	Extend Main Bridge to Land at North Side; Allow Left Exit to I-780	$1,675,000			
2.1	Find On-Site Fill Locations to Eliminate Export	$776,000			
2.2	Find On-Site Fill Locations to Eliminate Export	$1,916,000			
	CONNECT BRIDGE SOUTH				
3.1	Maximize Bulb Tees at Mococo	$1,605,000			
3.2	Restage South Approach from Eight Stages to Six Stages	$4,618,000			
4.0	Realign New Mococo Overhang Bridge to East	$4,152,000			
5.0	Move Toll Plaza on South Side Slightly North	$2,556,000	(LCC)		
6.0	MSE Wall at South Approach	$4,304,000			

*All savings are initial cost savings only, unless noted as LCC savings.

A = Accepted **CA = Conditionally Accepted** **R = Rejected**

SUMMARY AND DISPOSITION OF VA ALTERNATIVES – FINAL

The draft report contains the Summary and Disposition of Alternatives forms with implemented savings and comments left blank. The final report completes the summaries with implemented savings, dispositions, and comments for each alternative. No savings are recorded for design suggestions; however, dispositions and comments are encouraged for completeness of the final report.

Final Summary and Disposition of VA Alternatives. *The example Summary and Disposition of VA Alternatives shows how the blank draft forms are completed in the final report:*

- ***Implemented Savings*** *– The present value savings accepted by design team*
- ***Disposition*** *– Noted as A, CA, R (see page 4.6)*
- ***Comments*** *– Explanations and justifications for implementation decisions*

SUMMARY OF VA ALTERNATIVES *Benicia-Martinez Bridge Approaches*				FINAL	TVI International
Alternative Number	**Name**	**Potential Savings***	**Implemented Savings***	**Disposition**	**Comments**
	CONNECT BRIDGE SOUTH				
4.0	Realign New Mococo Overhang Bridge to East	$4,152,000	$4,152,000	A	Implemented for $4,152,000 savings. Environmental mitigation of sensitive habitat required. Staging simplified to avoid overlap of bridge structures.
5.0	Move Toll Plaza on South Side Slightly North	$2,556,000	(LCC)	ca	Requires environmental review prior to acceptance.
6.0	Extend Mococo Bridge South to Eliminate Polystyrene Fill	$163,000		R	Extending the bridge would cost more and delay the project. The fill was part of the design.
7.0	MSE Wall at South Approach	$4,304,000		R	Right-of-way already purchased and MSE not appropriate wall type for 60-foot high walls; requires pile foundation.
	IMPROVE ACCESS				
8.0	Northbound 780 to Existing Bridge; Bike Path to North Bridge	$17,141,000		R	This will delay the entire project for a few years.
	COLLECT TOLLS				
9.0	Relocate Toll Plaza to North Side of New Bridge	$3,995,000		R	Not feasible – was looked at before.

*All savings are initial cost savings only, unless noted as LCC savings.

VA ALTERNATIVE IMPLEMENTATION - DRAFT

The disposition of each VA alternative is documented by the stakeholders on the VA Alternative Implementation form. Technical feasibility, implementable portions, cost impact, validated cost savings, and schedule impact are noted and the disposition rationale is summarized to explain how the accept, conditionally accept, or reject disposition was determined. The Draft VA Study Report contains blank forms with VA alternative titles and numbers.

Draft VA Alternative Implementation. *The example draft VA Alternative Implementation form requests the following stakeholder responses:*

- ***Technical Feasibility*** *– Indicate how the technical feasibility of the VA alternative was evaluated.*
- ***Implementable Portions*** *– Identify which portions of the VA alternative can be implemented, and which require further study.*
- ***Validated Cost Savings*** *– Describe how the estimated cost savings of the VA alternative were verified.*
- ***Schedule Impact*** *– Give significant schedule impacts of the VA alternative.*
- ***Safety Impact*** *– Reduction in accident rates.*
- ***Traffic Operations Impact*** *– Improvement in level of service.*
- ***Issue Resolution*** *– What different issues were resolved.*
- ***Stakeholder/Partner Consensus*** *– How stakeholder/partner consensus was enhanced.*
- ***Other Benefits*** *– Any other non-financial benefits.*
- ***Comments*** *– Indicate any comments you have regarding the VA alternative.*
- ***Disposition***

  A = ***Accept*** *– Will be incorporated into the design*

  CA = ***Conditionally Accepted*** *– Will be studied further to validate the technical feasibility and/or the potential cost savings; or, acceptance may be dependent on the environmental document or other project decision document.*

  R = ***Reject*** *– will not be considered further.*
- ***Implemented Savings*** *– Actual savings to the project.*
- ***Stakeholders*** *– Names of persons participating in the implementation process: Project Development Team, VA Coordinator, VA Team Leader, and Other Stakeholders.*
- ***Approved by*** *– Name of individual approving the form.*
- ***Date*** *– Date form completed.*

VA ALTERNATIVE IMPLEMENTATION **DRAFT** ***Benicia-Martinez Bridge Approaches***	**Caltrans**
Title: Reduce Levels in North Interchange	**Alt. Number:** CBN-5
STAKEHOLDER RESPONSES	**DISPOSITION**
Technical Feasibility: *Indicate how the technical feasibility of the VA alternative was evaluated.*	☐ **Accept** ☐ **Conditionally Accept** ☐ **Reject**
Implementable Portions: *Identify which portions of the VA alternative can be implemented, and which require further study.*	**Implemented Savings:**
Validated Cost Savings: *Describe how the estimated cost savings of the VA alternative were verified.*	**Stakeholders:** **Project Development Team:**
Schedule Impact: *Give significant schedule impacts of the VA alternative*	**VA Coordinator:**
Safety Impact: *Reduction in accident rates.*	**VA Team Leader:** **VA Team Members:**
Traffic Operations Impact: *Improvement in level of service.*	**Other:**
Issue Resolution: *What different issues were resolved.*	
Stakeholder/Partner Consensus: *How stakeholder/partner consensus was enhanced.*	**Prepared by:**
Other Benefits: *Any other non-financial benefits.*	**Date:**

VA ALTERNATIVE IMPLEMENTATION - FINAL

The blank VA Alternative Implementation forms in the Draft VA Study Report are completed by the Project Development Team and are the basis of the discussion at the implementation meeting. The completed, approved forms are included in the final VA Study Report as back-up material to the Implementation Action section.

Final VA Alternative Implementation. *The example final VA Alternative Implementation form shows how the blank draft form is completed by the project decision makers. The italicized instructions may be omitted.*

- ***Stakeholder Responses –*** *each item that applies to the VA alternatives is noted to support the implementation decision.*
- ***Disposition*** *– Final disposition is recorded.*
- ***Implemented Savings*** *– Actual savings to the project.*
- ***Stakeholders*** *– Names of participants in the implementation process.*

VA ALTERNATIVE IMPLEMENTATION **FINAL** ***Benicia-Martinez Bridge Approaches***	**Caltrans**
Title: Reduce Levels in North Interchange	**Alt. Number:** CBN-5
STAKEHOLDER RESPONSES	**DISPOSITION**
Technical Feasibility: The PDT agrees that the left off is technically feasible.	☒ **Accept** ☐ **Conditionally Accept** ☐ **Reject**
Implementable Portions: The whole concept presented by the VA team will be implemented.	**Implemented Savings:** $11,000,000
Validated Cost Savings: The PDT estimated $11,000,000 savings (not $12,271,000).	**Stakeholders:** **Project Development Team:** Moe Pazooki **VA Coordinator:** H. Khorram **VA Team Leader:** R. Sperling **VA Team Members:** None Present **Other:**
Schedule Impact: The new bridge span must be redesigned; schedule impact not known.	
Safety Impact: The initial left off to Benicia will reduce weaving at north end of new span.	
Traffic Operations Impact: No improvement in level of service is anticipated.	
Issue Resolution: The application of the "no left off-ramps" standard.	
Stakeholder/Partner Consensus: The Benicia City Council was asked to approve the left off concept.	**Prepared by:** Liz Wiecha
Other Benefits: No other non-financial benefits are anticipated.	**Date:** 10-1-98

VA Alternatives

VA ALTERNATIVES

The VA Alternatives section contains the documented VA alternatives, complete with technical and cost backup information. Most of the information is transcribed to improve legibility and facilitate communication of the study results.

VA Alternatives. *The example VA Alternatives section introduces the VA alternatives and design suggestions in four sub-sections:*

Introduction. *The content of the study results is summarized.*

VA Alternatives. *A brief description of alternatives and design suggestions is given.*

Alternative Groups. *The design team is alerted to the groupings of VA alternatives by project elements (e.g., roadway, structures) and the mutually exclusive identifiers that help guide the implementation process.*

Evaluation of Alternatives. *The stakeholders are encouraged to evaluate all alternatives, including those identified by the VA team as having the highest likelihood of improving the project.*

Document Review. *Errors and omissions noted by the VA team during its review of the design documents are listed, so the designer can make necessary corrections.*

VA ALTERNATIVES

INTRODUCTION

The results of this study are presented as individual alternatives to the original concept. In addition, design suggestions for improving the project are included for consideration by the stakeholders.

VA ALTERNATIVES

Each alternative consists of a summary of the original concept, a description of the suggested change, a cost comparison, a listing of its advantages and disadvantages, and a brief narrative comparing the original design with the alternative. Sketches, calculations, and benefits are also presented. The cost comparisons reflect the comparable level of detail as in the original estimate. A life cycle benefit-cost analysis for major alternatives is included where appropriate. Design suggestions are written summaries of partially developed ideas without supporting documentation.

ALTERNATIVE GROUPS

A Summary of VA alternatives and detailed descriptions of the alternatives are on the following pages. The alternatives are grouped by project element for east of comparison by the design team. Each group may contain mutually exclusive alternatives, where only one alternative in a group can be implemented. However, there are exceptions to the mutually exclusive rule, and the design team should carefully evaluate the alternatives to determine which alternatives can be combined for the benefit of the project.

EVALUATION OF ALTERNATIVES

The VA team performs an initial evaluation of the alternatives in preparation for their presentation to the project stakeholders. The alternatives the team identifies as having the highest likelihood of improving the project are highlighted on the Summary of Alternatives list. The project stakeholders are, however, encouraged to evaluate all VA alternatives on their individual merit, selecting the ones, in whole or in part, to be implemented.

DOCUMENT REVIEW

The VA team used the design documents of the original concept as the basis of the study. While reviewing the plans, schedules, costs, and other supporting documentation, the team noted ways the design team could improve the documents. These are summarized below.

- There were no significant corrections noted by the VA team on this project.

SUMMARY OF VA ALTERNATIVES

At the conclusion of the development phase, the VA team and Team Leader review all alternatives and design suggestions in preparation for their presentation to the stakeholders. The Summary of VA Alternatives form is used to list all of the team results. The alternatives are placed in groups and mutual exclusivity is determined (if one alternative is implemented others cannot be).

Summary of VA Alternatives. *The example Summary of VA Alternatives lists each alternative by group:*

- ***Group*** *– Groups are established to gather like alternatives and/or mutually exclusive alternatives into one group to facilitate evaluation and implementation*
- ***Alternative Number*** *– Alternative number is sequential (1.0, 2.0, 3.0), with mutually exclusive alternatives given the same number with decimal designators (3.1, 3.2, 3.3). Starred (*) numbers mark alternatives identified by the VA team as having the highest likelihood of improving the project.*
- ***Title*** *– Title of alternative as shown on the VA alternative form.*
- ***Potential Saving*** *– Total potential savings as shown on the VA alternative form. Distinguish between cost savings and life cycle cost savings (LCC following number).*
- ***Notes*** *– Mutually exclusive alternatives are identified*

Identifying mutually exclusive alternatives allows the VA team to report realistic potential savings. As shown in the example, the structure alternative could yield $3,330,000 maximum savings from Alternative 1.1 because Alternative 1.2 ($246,000) could not be implemented also. Further, the grouped alternatives guide the stakeholders in their implementation decisions (Alternative 5.1 or 5.2 can be implemented, but not both).

SUMMARY OF VA ALTERNATIVES *Vasco Road / I-580 Interchange*		Caltrans
Alternative Number	**Title**	**Potential Savings**
	Structure	
1.1*	Utilize Existing Structure by Widening	$3,330,000
1.2	Reduce BART Median Width to Shorten Structure	$246,000
	Ramps	
2.0*	Separate Ramp Entrances to Westbound I-580 (Two in lieu of One)	$1,680,000 (LCC)
3.0*	Implement Eastbound Ramp's Final Configuration for Minimum Project Alternative	$76,000
	Mainline	
4.0	Use Existing Guardrails in lieu of Concrete Barriers in Median	$1, 072,000
5.1	Use Fast-Dry Portland Cement Concrete in lieu of Asphalt Concrete	$139,000
5.2	Revise Asphalt Concrete Section	$214,000
	Local Streets	
6.0*	Widen Vasco Road Only Eastward	$35,000
7.0	Relocate Frontage Road to Franklin Lane	$42,000
	Note: 1. Alternative numbers, 1.1, 1.2, identify mutually exclusive alternatives; only one may be implemented. 2. LCC identifies life cycle cost savings; others are initial cost savings only. 3. Starred (*) numbers mark alternatives identified by the VA team as delivering the best value..	

SUMMARY OF VA DESIGN SUGGESTIONS
Vasco Road / I-580 Interchange

Idea Number	Title
AB-7	Realign BART North of I-580 West of Vasco in lieu of East of Vasco
AB-10	Realign BART South of I-580; Connect with Altamont Commuter Rail
AB-18	Have BART Share Cost of Median Widening
AB-26	Coordinate I-580 Widening with BART
WF-5	Revisit Assessment for Soundwalls
WF-8	Review Drainage Cost Estimate
WF-12	Use "Living Wall" in lieu of Concrete Soundwalls
WF-20	Coordinate I-580 Current Barrier Project with Alternative H
MR-22	Extend Springtown Boulevard North to Vasco as Shunt
MR-24	Reexamine Traffic Study to Account for New Local Roads
WV-5	Redesign Local Streets Adjacent to Interchange
WV-14	Have US Department of Energy Pay for Widening Vasco Road
WV-15	Connect Greenville Road North to Vasco as Shunt
MP-1	Shorten Time for Environmental Clearance Phase in Schedule
MP-2	Increase Time for Right-of-Way Certification by Combining Geometric Mapping with Appraisal Mapping
MP-7	Include Costs for Environmental Mitigation in Cost Estimate
MP-8	Carry Only Alternative H to Environmental Review
MP-9	Combine Alternative H with MPA as One Overall Project
MP-18	Widen South Frontage Road in lieu of Widening Eastbound I-580

MANAGEMENT PRESENTATION COMMENTS

The comments made by the managers during the VA team's presentation are recorded n the Management Presentation Comments form and included in the VA Alternatives section of the VA Study Report. While they are among the final words spoken during the study, they also represent some of the initial thoughts leading to implementation of the VA alternatives. Care in documenting these comments provides guidance to the project development team in evaluating the VA alternatives for implementation.

Management Presentation Comments. *The example Management Presentation Comments form illustrates notes recorded by the VA team. See the VA Team Guide for detailed instructions for completing this form.*

MANAGEMENT PRESENTATION COMMENTS *I-10 HOV Widening, Baldwin Avenue to I-605*			**Caltrans**
LOCATION: District 4		**DATE:** 6/26/98	**PAGE:** 1 of 1

Number	Title	Name	Comments
—	Whole VA Study	District Director	The VA team was amazingly creative. We thank all of you for your input to this important project. We know it takes you away from other responsibilities, but this is an important part of your job.
4.0	Reduce Levels of North Interchange	Project Engineer	The alternative to move Mococo Bridge to the east will also reduce the amount of work required on the existing bridge. The impact on the on-ramps is not a big issue.
1.2	Realign FN Line at North End	Project Manager	While realignment of northbound I-680 to the westbound I-780 line affects the future light rail alignment, it is still possible to have the light rail in the median of I-680.
1.1	Reduce Levels of North Interchange	Program Manager	Changing the "right-off" to I-780 violates our standard. We will review the $12,271,000 savings potential and look at the "left-off" option.

VA ALTERNATIVE DOCUMENTATION

Each VA alternative is a multi-page write-up of the developed idea or combination of ideas that were highly ranked in the evaluation phase of the study. The figure on the following page illustrates the forms that are used and their sequence for a fully developed alternative including:

- Summary Description : Original and alternative concepts; advantages and disadvantages; discussion/justification; implementation plan
- Sketches: Graphics for original and alternative concepts
- Calculations: Technical quantities, calculations, and assumptions
- Benefits: Summary of non-financial benefits
- Initial Costs: Estimates of original and alternative initial costs
- Life Cycle Costs: Total of initial and subsequent costs

All of the documentation is transcribed for improved readability.

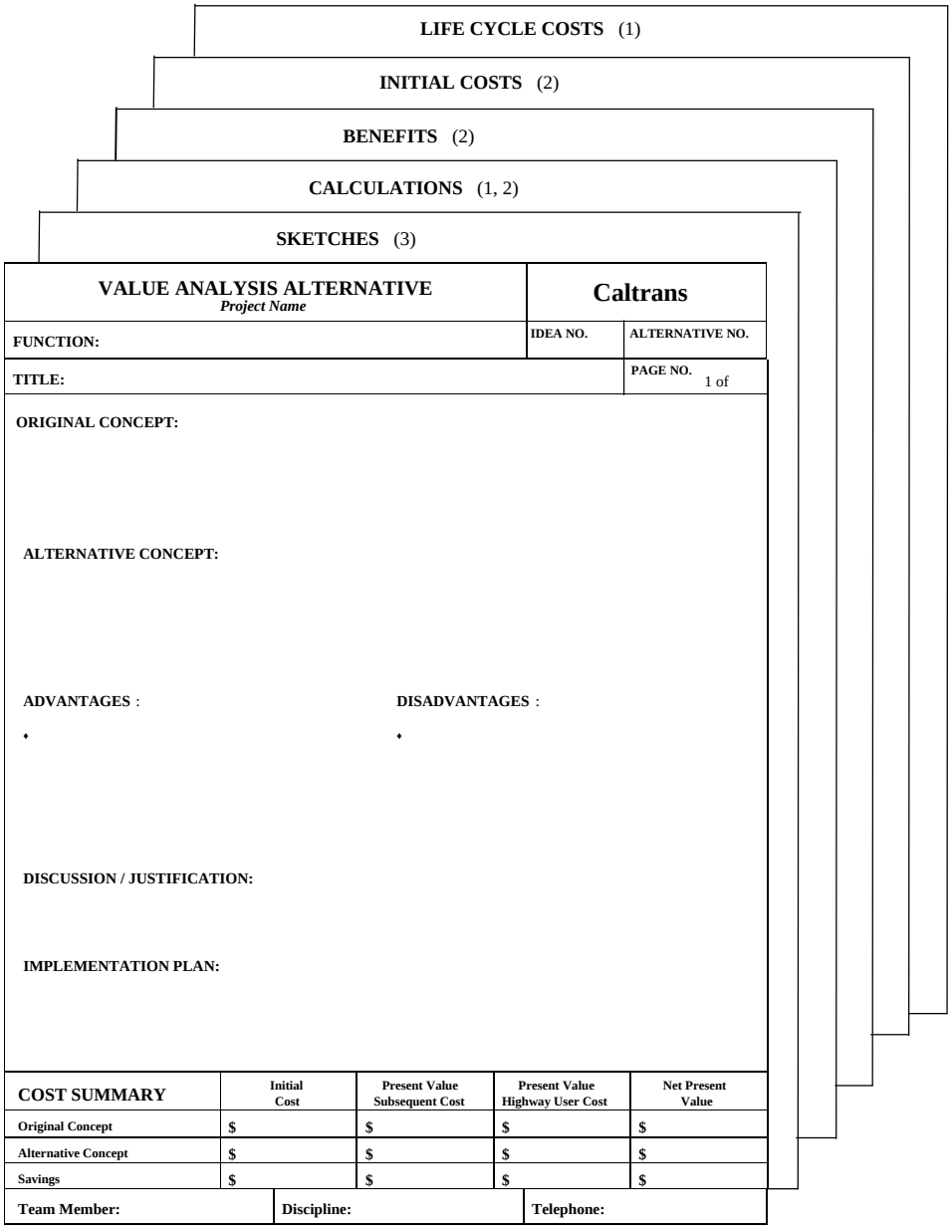
Design suggestions, brief summaries of ideas without detailed calculations or cost estimates, require only the top sheet.

Explanations of each form used to document the VA alternatives and design suggestions follow with examples; blank forms are included in the back of this Report Guide.

VA Alternative. *The example VA Alternative illustrates the six pages of documentation required for an alternative. See the VA Team Guide for detailed instructions for completing these forms.*

VA ALTERNATIVE DOCUMENTATION

A complete VA Alternative is a stand-alone document using the following forms:



Notes: (1) Optional, depending on needs of the alternative
(2) Additional back-up sheets may support calculations, benefits, and costs
(3) Include original and alternative sketches

VALUE ANALYSIS ALTERNATIVE *I-10 HOV Widening, Baldwin Avenue to I-605*		Caltrans
FUNCTION: Support Load (East El Monte Overhead)	**IDEA NO.** EM-1	**ALTERNATIVE NO.** 2.3
TITLE: Use Alternative Superstructure in lieu of Steel		**PAGE NO.** 1 of 6

ORIGINAL CONCEPT:

The original concept widens the existing structure with steel girders.

ALTERNATIVE CONCEPT:

Use precast girders to widen the structure on the left, and use a post-tensioned box girder on the right.

ADVANTAGES:

- Saves construction cost
- Improves schedule
- Eliminates only steel structure on project
- Reduces long-term maintenance (painting)
- Reduces pier width

DISADVANTAGES:

- Box girder section would require railroad and Public Utility Commission approval for vertical clearance
- Box girder would be continuous next to existing simple spans
- Requires redesign and increases design schedule

DISCUSSION / JUSTIFICATION:

Instead of widening the structure "in kind" with steel girders, using precast girders and post-tensioned box girders eliminates the only steel structure on the project.

The use of more conventional structure types saves cost. Also, the delivery time for welded plate girders is typically much longer than for precast girders (see SL-1). This alternative is consistent with the project manager's request that the VA team find alternatives that reduce construction time and impacts to the traveling public.

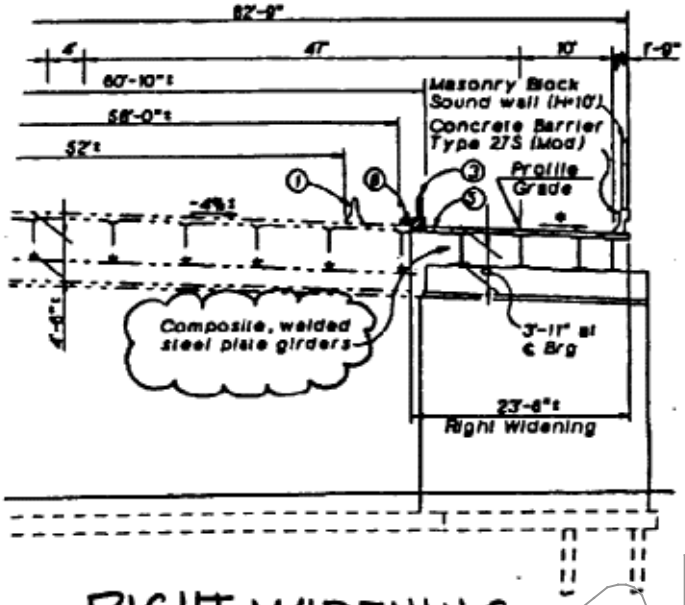
IMPLEMENTATION PLAN:

A new type selection and redesign would be required. Redesign cost (at 3%) is included in the alternative cost estimate.

COST SUMMARY	Initial Cost	Present Value Subsequent Cost	Present Value Highway User Cost	Net Present Value
Original Concept	$ 3,852,720	$ 5,500	$ 10,050	$ 3,868,270
Alternative Concept	$ 2,907,528	$ 4,600	$ 5,500	$ 2,917,628
Savings	$ 945,192	$ 900	$ 4,550	$ 950,642

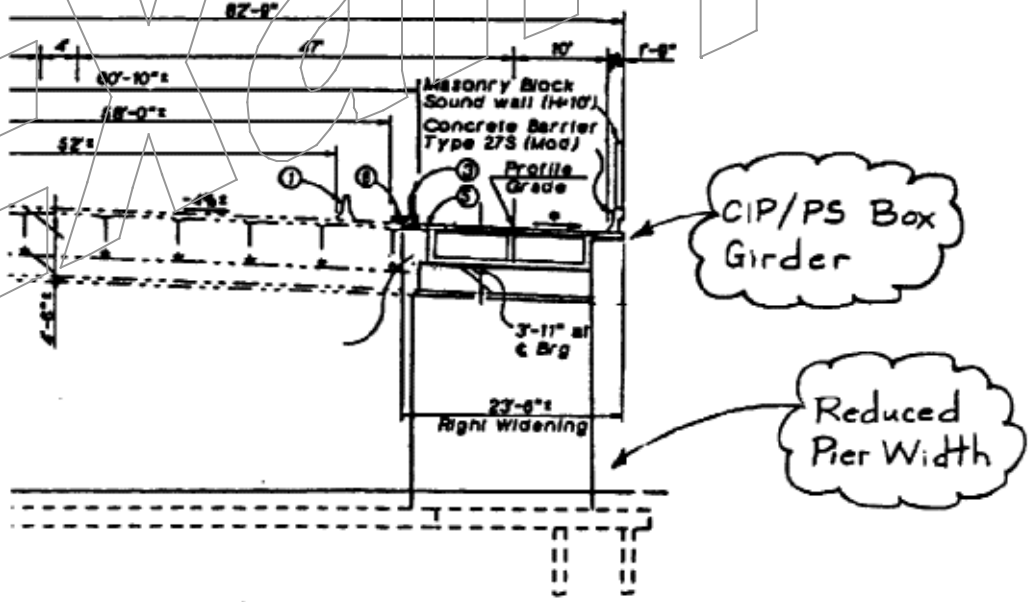
Team Member: M. Creveling	**Discipline:** Bridge	**Telephone:** 619-566-3113

SKETCHES *I-10 HOV Widening, Baldwin Avenue to I-605*		Caltrans	
TITLE:	Use Alternative Superstructure in lieu of Steel	**IDEA NO.** EM-1	**PAGE NO.** 2 of 6



RIGHT WIDENING

ORIGINAL



Right Widening

ALTERNATE

Calculate area of steel for painting:

Girder	Average Length	Average Flange Width	Web Depth	Number	Area
G1-G4	91’	14”	34.5”	4	3,367 SF
G5-G8	99’	18”	34.4”	4	4,052 SF
G9-G13	75’	14”	40.5”	5	3,844 SF
G14-G18	78’	14”	40.5”	5	3,998 SF
					15,261 SF

Assumptions:

Painted area = 3 x Flange + 2 x Web x Length x Number

Assume clean and paint structural steel = $1.50/SF

Cost per painting = $23,000

Assume structure has to be painted once every 20 years.

Roadway Approaches

Original Concept:	(200’ length x 84’ width) x 2 sides	=	33,600 SF
VA Concept:	150’ x 84’ x 2	=	25,200 SF

BENEFITS *I-10 HOV Widening, Baldwin Avenue to I-605*		Caltrans	
TITLE:	Use Alternative Superstructure in lieu of Steel	**IDEA NO.** EM-1	**PAGE NO.** 4 of 6

SCHEDULE IMPROVEMENTS:

Delivery time for welded plate girders typically is longer than for precast girders and post-tensioned box girders. Design schedule increases approximately 22 working days (one month).

SAFETY IMPROVEMENTS:

No impact on safety can be expected after construction. However, simplifying construction may improve safety during construction. No quantifiable data provided.

TRAFFIC OPERATIONS:

No impact on traffic operations is foreseen after construction. However, simpler construction will help traffic control during construction. Design speed for original concept and alternative concept both 60 mph (no change).

ISSUE RESOLUTION:

Contractor laydown area limited in this congested corridor. Fewer construction types (from 8 to 3) will help contractor with staging and reduction in laydown areas.

STAKEHOLDER/PARTNER CONSENSUS:

Local business owners are concerned about disruptions to access to their businesses during construction. This idea can help reduce this problem and encourage their "buy-in" for the project.

OTHER BENEFITS:

No other non-financial benefits were identified.

INITIAL COSTS
I-10 HOV Widening, Baldwin Avenue to I-605

Caltrans

TITLE: Use Alternative Superstructure in lieu of Steel

ALT. NO.	PAGE NO.
EM-1	5 of 6

CONSTRUCTION ELEMENT		ORIGINAL CONCEPT			ALTERNATIVE CONCEPT		
Description	**Unit**	**Quantity**	**Cost/Unit**	**Total**	**Quantity**	**Cost/Unit**	**Total**
ROADWAY ITEMS							
Roadway Approaches	SF	33,600	$30	$1,008,000	25,200	$30	$756,000
ROADWAY SUBTOTAL				*$1,008,000*			*$756,000*
MARK-UP	***15%***			*$151,200*			*$113,400*
ROADWAY TOTAL				*$1,159,200*			*$869,400*
STRUCTURE ITEMS							
East El Monte	SF	10,320	$261	$2,693,520			
R					3,876	$190	$736,440
L					6,444	$202	$1,301,688
STRUCTURE SUBTOTAL				*$2,693,520*			*$2,038,128*
STRUCTURE MARK-UP	***%***			$0			$0
STRUCTURE TOTAL				*$2,693,520*			*$2,038,128*
RIGHT-OF-WAY ITEMS							
Right-of-Way Acquisition							
Utility Relocation							
Relocation Assistance							
Demolition							
Title and Escrow Fees							
RIGHT-OF-WAY TOTAL				*$0*			*$0*
ENVIRONMENTAL MITIGATION ITEMS				$0			$0
CAPITAL OUTLAY SUPPORT ITEMS				$0			$0
Reengineering and Redesign (3%)							
Project Engineering							
TOTAL				$3,852,720			$2,907,528
						SAVINGS	$945,192

LIFE CYCLE COSTS *I-10 HOV Widening, Baldwin Avenue to I-605*				**Caltrans**	
TITLE: Use Alternative Superstructure in lieu of Steel				**NUMBER** EM-1	**PAGE NO.** 6 of 6
Life Cycle Period 20 Years	Real Discount Rate 4.75%			**ORIGINAL**	**ALTERNATIVE**
A. INITIAL COST				$3,852,720	$2,907,528
Service Life-Original 35 Years Service Life-Alternative ____ Years	**INITIAL COST SAVINGS:**				$945,192
B. SUBSEQUENT ANNUAL COSTS					
1. Maintenance and Inspection				$500	$400
2. Operating					
3. Energy					
Total Subsequent Annual Costs:				$500	$400
Present Value Factor (P/A):				10.000	10.000
PRESENT VALUE OF SUBSEQUENT ANNUAL COSTS:				$5,000	$4,000
C. SUBSEQUENT SINGLE COSTS	**Year**	**Amount**	**PV Factor (P/F)**	**Present Value**	**Present Value**
Rehabilitations - Original	5	1,000	0.5	$500	
Rehabilitations - Alternative	10	2,000	0.3		$600
Repairs - Original				$0	
Repairs - Alternative					$0
Expended Service Life - Original				$0	
Expended Service Life - Alternative					$0
Salvage - Original				$0	
Salvage - Alternative					$0
PRESENT VALUE OF SUBSEQUENT SINGLE COSTS:				$500	$600
D. TOTAL SUBSEQUENT ANNUAL AND SINGLE COSTS (B+C)				$5,500	$4,600
E. HIGHWAY USER ANNUAL COSTS				**Present Value**	**Present Value**
1. Accident				$10,000	$5,000
2. Travel Time				$0	$0
3. Vehicle Operating				$50	$500
TOTAL HIGHWAY USER ANNUAL COSTS:				$10,050	$5,500
F. TOTAL PRESENT VALUE COST (A+D+E)				$3,868,270	$2,917,628
TOTAL LIFE CYCLE SAVINGS:					$950,642

VA DESIGN SUGGESTION DOCUMENTATION

Each VA design suggestion is a single page write-up of the partially developed ideas that were ranked "6" in the evaluation phase of the study. The figure on the following page illustrates the form that is used to document the design suggestion.

Normally, design suggestions are brief summaries of ideas without sketches, calculations, benefits, or cost estimates. However, a partially developed idea may include sketches and other back-up information to aid evaluation by the stakeholders.

Design Suggestion. *The example Design Suggestion illustrates a completed form. See the VA Team Guide for detailed instructions for completing the Design Suggestion documentation.*

DESIGN SUGGESTION DOCUMENTATION

A complete VA Design Suggestion briefly summarizes an alternative idea using the following forms:

SKETCHES (1, 2)

VALUE ANALYSIS DESIGN SUGGESTION *Project Name*	**Caltrans**	
FUNCTION:	**IDEA NO.**	**PAGE NO.** 1 of
TITLE:		

ORIGINAL CONCEPT:

ALTERNATIVE CONCEPT:

ADVANTAGES :

•

DISADVANTAGES :

•

DISCUSSION / JUSTIFICATION:

IMPLEMENTATION PLAN:

Team Member:	**Discipline:**	**Telephone:**

Notes: (1) Optional, depending on needs of design suggestion
(2) Additional back-up sheets may support design suggestion

VALUE ANALYSIS DESIGN SUGGESTION *I-10 HOV Widening, Baldwin Avenue to I-605*	**Caltrans**	
FUNCTION: San Gabriel River Structure	**IDEA NO.** SG-18	**PAGE NO.** 1 of 1
TITLE: Use a Reinforced Box Girder in lieu of T-Beam		

ORIGINAL CONCEPT:

The original design calls for a cast-in-place T-beam superstructure.

ALTERNATIVE CONCEPT:

Change superstructure to a reinforced concrete box girder.

ADVANTAGES:

- More common and efficient structure type
- More consistent with other structures on the project
- May save cost
- May allow for a single row of piles at piers
- Better seismically

DISADVANTAGES:

- Redesign cost and schedule
- May prove to be more expensive

DISCUSSION / JUSTIFICATION:

The cast-in-place T-beam is not a common structure type due to difficult construction and more efficient sections; therefore, utilizing a reinforced concrete box girder will allow a less expensive structure.

IMPLEMENTATION PLAN:

A new type selection and redesign are required.

Team Member: M. Creveling	**Discipline:** Bridge	**Telephone:** 619-566-3113

Project Analysis

SUMMARY OF ANALYSIS

The Project Analysis report section gathers together the results from the application of the VA tools during the study and summarizes the key findings that guided the VA team's work.

The Project Analysis summary lists the VA tools used by the VA team:

- **Cost Models**
- **Function Analysis**
- **FAST Diagram**
- **Cost-Function Analysis**
- **Evaluative Criteria Matrix**
- **Weighted Comparison Matrix**
- **Life Cycle Benefit-Cost Analysis**

Each of the tools is explained individually in this section of the report and the results are fully documented.

> ***Summary of Analysis.*** *The example Summary of Analysis paragraph is a digest of the significant findings from these analyses. It is repeated in the Executive Summary under the heading Project Analysis.*

PROJECT ANALYSIS

SUMMARY OF ANALYSIS

The following value analysis tools were used to study the project:

- Cost Model
- Function Analysis/FAST Diagram
- Cost/Function Analysis
- Evaluative Criteria Matrix
- Weighted Comparison Matrix
- Highway User Life Cycle Benefit-Cost Analysis

The results of these analyses clarified the Vasco Road / I-580 Interchange project. The largest cost item is the *Structure* and the basic function of the project is *Relieve Congestion.* The greatest cost assigned to a function is 41% for *Accommodate BART.* The cost/worth analysis identifies approximately $3,000,000 in potential savings. The key evaluative criteria are Vasco performance, freeway performance, and right-of-way/access.

The weighted evaluation suggests that the VA alternatives have potential for improving both function and cost for the project. The benefit/cost analysis is not included because there are no projected traffic improvements for the one-mile segment of I-580 as a result of this project.

COST MODEL

A cost model is a synthesis of the project cost estimate, reducing often-voluminous documents to single pages, making the cost estimate for the project more readily understood. The cost model also reorders the estimated costs to highlight the significant cost drivers for a project. By gathering costs into functional descriptions, construction trade categories or project element groupings, the VA team gains an appreciation for the high cost contributors. A Pareto Analysis also helps establish priorities for further analysis.

***Cost Model**. The example Cost Model organizes the project cost information in two ways:*

- ***Cost Table.** The costs are ordered from lowest to highest cost. A Pareto Analysis can be done to isolate the "20% of the items that represent 80% of the costs" for the project.*
- ***Pareto Chart.** Charting the figures from the cost table results in a graphic depiction of the high cost items, furthering the isolation of project elements that require more analysis.*

COST MODEL

The VA team leader prepared a series of cost models from the designer's cost estimates. The models are organized to identify major construction elements or trade categories, the designer's estimated costs, and the percent of total project cost for the significant cost items.

These cost models clearly showed the cost drivers for the project and were used to guide the VA team during the VA Study.

- Alternative H, Total Project: The support costs are the largest cost item, followed by structure items and pavement section.
- Alternative H, High Cost Items: The structure, pavement section, and right-of-way are the three highest cost items.
- Minimum Project Alternative, Total Project: Engineering and management and pavement section are the cost drivers.
- Minimum Project Alternatives, High Cost Items: Pavement section is the cost driver.

COST MODEL

Value Analysis Study

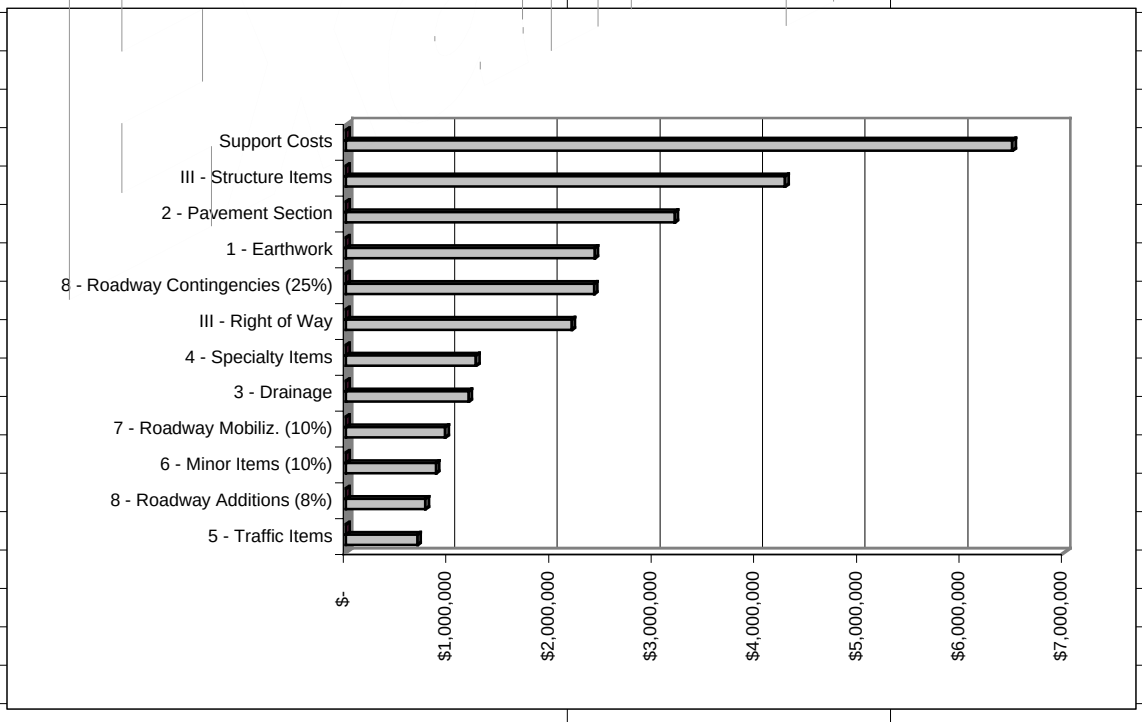
Vasco Road / I-580 Interchange

Alternative H - Preliminary Cost Estimate, 8-19-98

TOTAL PROJECT

Item		Cost	Percent
5 - Traffic Items	$	697,000	2.6
8 - Roadway Additions (8%)	$	773,400	2.9
6 - Minor Items (10%)	$	878,800	3.3
7 - Roadway Mobiliz. (10%)	$	966,700	3.6
3 - Drainage	$	1,194,500	4.5
4 - Specialty Items	$	1,267,600	4.7
III - Right of Way	$	2,200,000	8.2
8 - Roadway Contingencies (25%)	$	2,416,800	9.0
1 - Earthwork	$	2,424,300	9.0
2 - Pavement Section	$	3,205,000	12.0
III - Structure Items	$	4,280,000	16.0
Support Costs	$	6,494,000	24.2
Total	$	26,798,100	100.0

78% of the costs (21,020,100) are contained in
50% of the items (6 of 12)



FUNCTION ANALYSIS

Function analysis results in a unique view of the purpose and goals of the study project. It transforms project elements into functions, which moves the VA team mentally away from the original design and takes it toward a functional concept of the project. Functions are defined in verb-noun statements to reduce the needs of the project to their most elemental level. Functions are categorized as *Basic, Secondary, Required Secondary, Aesthetic, Unwanted, Higher Order,* and *Assumed* to further the analysis. Identifying the functions of the project allows a broader consideration of alternative ways to accomplish the functions.

In some cases the cost of functions is compared to its worth, defined as the least cost to accomplish that function. High cost-worth ratios indicate targets for value improvement.

Function Analysis. *The example Function Analysis form records the following:*

- ***Description*** *– The total project or an individual project element (Interchange)*
- ***Function*** *– An active* ***Verb*** *and a measurable* ***Noun***
- ***Type of Function***
  - *B = Basic – Specific work that must be accomplished*
  - *S = Secondary – Work subordinate to basic function*
  - *RS = Required Secondary – Necessary for basic function to perform better*
  - *AS = Aesthetic – Improves appearance or aesthetics; a "sell" function*
  - *U = Unwanted – Undesirable by-products adding cost to mitigate*
  - *HO = Higher Order – Objective or output; outside scope*
  - *A = Assumed – Initiator or input; outside scope*
- ***Cost*** *– The cost of a function*
- ***Worth*** *– The worth of a function (least cost)*
- ***Number*** *– Number of the item*

FUNCTION ANALYSIS / FAST DIAGRAM

Function analysis was performed and a FAST Diagram was produced, which revealed the key functional relationships for the project. This analysis provided a greater understanding of the total project and how the issues, project cost, and function requirements are related.

The FAST diagram shows *Increase Capacity* as the basic function, with secondary functions for *Widen I-580, Widen Vasco,* and *Modify Ramps.* The *Replace Bridge* function serves to *Accommodate BART* (at 41% of the cost – a very significant finding), as well as *Widen I-580* and *Widen Vasco.*

The Cost/Worth analysis reveals potential savings of $2,750,000 as determined by the VA team prior to detailed analysis. It is interesting to note that the potential savings identified later by the VA team total approximately $3,300,000. Thus, the VA team achieved the worth goal it established at the start of the study.

FUNCTION ANALYSIS
Vasco Road / I-580 Interchange

Caltrans

No.	Description	Function			Cost	Worth	Comments
		Verb	**Noun**	**Kind**			
	PAVEMENT	Support	Loads	S	$3,200,000	$3,000,000	
		Define	Roadway	S			
		Carry	Traffic	B			
		Carry	Water	S			
		Pond	Water	U			
	RIGHT-OF-WAY	Defines	Property	RS	$2,200,000	$1,800,000	
		Provide	Space	S			
		Provide	Access	B			
		Access	Land	S			
		Limits	Design	U			
	IMPORTED BORROW	Support	Loads	S	$1,300,000	$1,200,000	
		Raise	Grade	B			
		Compact	Roadbed	S			

Function: **Active Verb** **Measurable Noun**

Kind: **B** = **Basic** **S** = **Secondary**

HO = **Higher Order** **A** = **Assumed** **U** = **Unwanted**

FAST DIAGRAM

The Function Analysis System Technique (FAST) Diagram is a logic diagram that arranges the random functions into *How? Why? When?* relationships. This diagram helps determine the basic and secondary functions, which serves to clarify the functional purpose for the whole project and elements of the project.

The random functions are arranged by selecting a candidate basic function and placing it on the left side of the diagram. By asking *How?* more functions are added horizontally to the right. By asking *Why?* the functional relationships are tested and confirmed to the left. Vertical patterns represent *When?* relationships, or subordinate functions that happen at the same time or are caused by secondary functions.

The FAST diagram stimulates team discussion of the functions for the project under study. There is no perfect, complete diagram; the value of the analysis is that it focuses the team on the essential elements of the project in terms of functions to ensure that less important aspects of the project do not dominate the discussion.

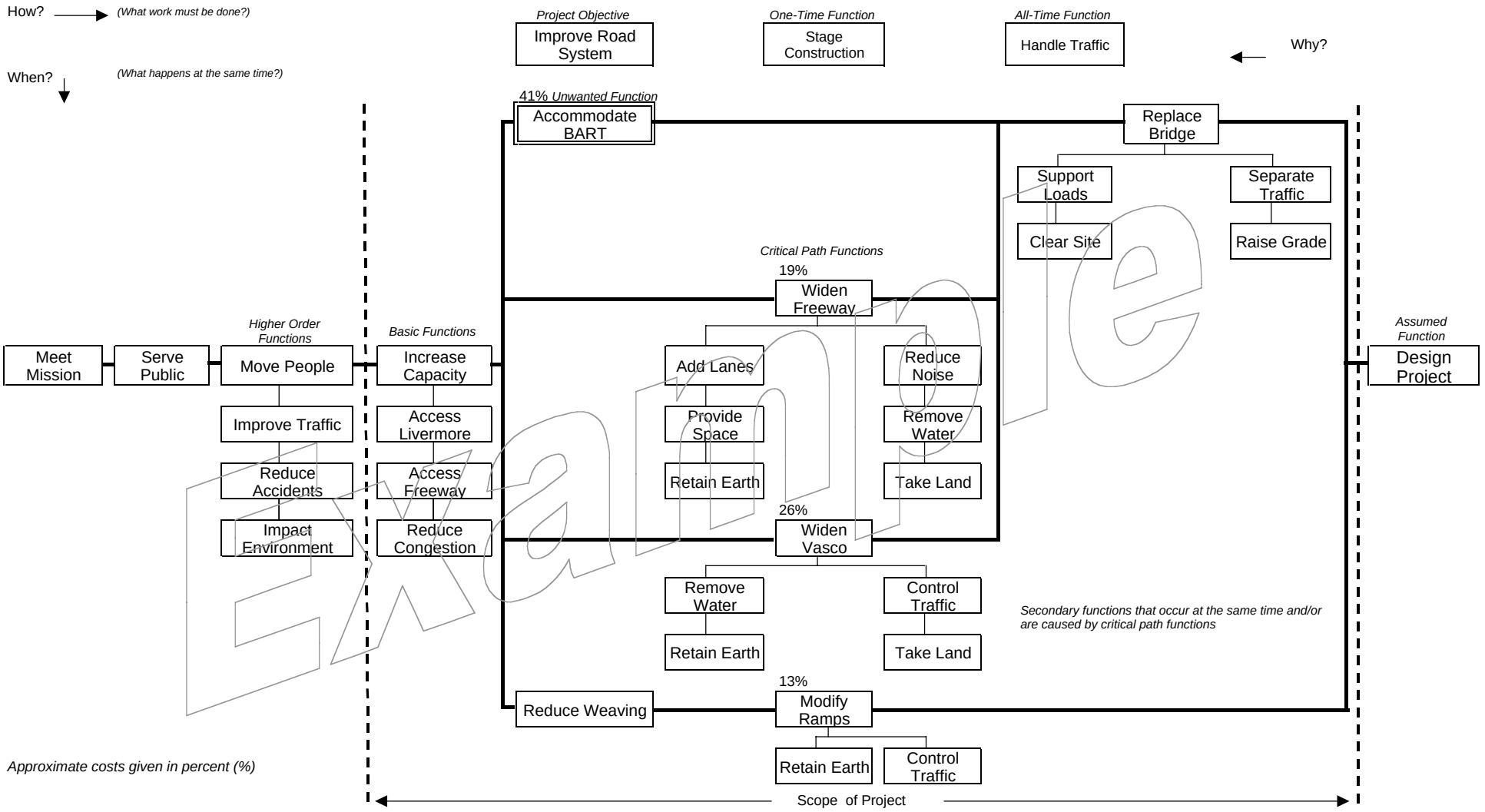
FAST Diagram. *The example FAST Diagram illustrates the arrangement of random functions into a critical logic path. The steps to construct the diagram are:*

- ***Basic Function*** *– Locate the presumed Basic Function to the right of the left scope line.*
- ***Ask "How?"*** *– Verbalize the question, "How do we (verb-noun)?" or "What work must be done to (verb-noun)?" Place the functional answer to the right. Continue until there is no logical answer to the "How" question.*
- ***Ask "Why?"*** *– Verbalize the question, "Why do we (verb-noun)?" Validate the functional answers to the left. If a pair of functions does not answer the "How?", "Why?" questions, one or both are changed until the logic is sound.*
- ***Ask "When?"*** *– Secondary functions are placed under the critical logic path as responses to "When?, or "What happens at the same time as (verb-noun)?", or "What is caused by (verb-noun)?"*
- ***Other*** *– Adding other functions above the critical path identifies them as "one time" or "all the time" functions such as design goals or criteria. Unwanted functions are highlighted.*
- ***Costs*** *– Percentage or dollar costs are added following the cost-function analysis (see page 6.12-6.14).*

As the VA study proceeds, the FAST Diagram is adjusted to accommodate new understandings of the functional requirements.

FAST DIAGRAM
Vasco Road / I-580 Interchange

Caltrans



COST/FUNCTION ANALYSIS

Cost/Function Analysis is a merging of the Cost Model and the FAST Diagram. Assigning cost to functions furthers the function analysis by showing high cost functions, as compared to the high cost items. The VA team is then able to approach the creativity session with a cost-function matrix that highlights the costs required to accomplish functions and to search for alternatives to accomplish them. This opens the door to creative solutions that would not necessarily be apparent if the approach of seeking cost reductions of project parts were used.

Cost/Function Analysis. *The example Cost/Function Analysis includes the following data:*

- ***Items*** *are entered in the left column (Bridge Structure)*
- ***Functions*** *are listed as column headings (Accommodate BART))*
- ***Costs*** *from items in the cost model are assigned to functions, either wholly or in estimated portions, some cost to two or more functions ($4,300,000)*
- ***Total costs*** *for each function are calculated ($6,090,000)*
- ***Percentage*** *of costs by function are calculated (41%)*

The function costs also are added to the FAST diagrams (see pages 6.10-6.11).

COST/FUNCTION ANALYSIS

The VA team completed a cost/function analysis by apportioning the costs of items to their functions. The total cost assigned to each function was transferred to the FAST diagram.

The analysis showed that approximately 41% of the cost is for *Accommodate BART*, and 26% is for *Widen Vasco.* This finding is significant because the presumption that BART will use an I-580 median right-of-way at the Vasco Interchange in the foreseeable future (20 years) requires significant costs not related to improving the interchange itself.

COST/FUNCTION ANALYSIS
Vasco Road / I-580 Interchange

Caltrans

High Cost Item	FUNCTIONS				
	Est. Cost $1,000	**Accommodate BART**	**Widen I-580**	**Widen Vasco**	**Modify Ramps**
Bridge Structure	$4,300	$3,000		$1,300	
Pavement	$3,200		$1,600	$800	$800
Right-of-Way	$2,200	$1,500		$700	
Imported Borrow	$1,300	$900		$400	
Drainage	$1,200		$600	$300	$300
Excavation	$860	$200	$200	$200	$260
Barriers	$540	$270	$270		
Retaining Walls	$410				$410
Signals	$360			$120	$240
Soundwalls	$290		$290		
Demolition	$220	$220			
*** TOTAL**	$14,880	$6,090	$2,960	$3,820	$2,010
*** %**	100%	41%	20%	26%	13%

* of 11 high cost items

EVALUATIVE CRITERIA MATRIX

The Evaluative Criteria Matrix is used to select the key evaluative criteria to be applied to the creative ideas. Candidate criteria are listed randomly, as contributed by the stakeholders, designer and VA team. The matrix allows comparison of each criterion with all others in turn. The results give a ranking so that the top four or five criteria can be used to evaluate the creative ideas.

Evaluative Criteria Matrix. *The example evaluative criteria matrix demonstrates the results using the following procedure:*

- ***List Criteria*** *– List the candidate criteria in the left part of the form; assign designators (A, B, C).*
- ***Discuss Pairs*** *– Compare criterion A with criterion B asking, "Which is most important to the project?" Enter A in the intersecting box (next to the A designator and above the B designator). Continue for all pairs until matrix is completed.*
- ***Total Scores*** *– Add the number of times each criterion was selected (4 for A, Construction Cost). Half scores result from ties, where criteria are judged to be of equal importance (d/e and b/g).*
- ***Normalize Scores*** *– Calculate percentages for each criterion, rounding off as needed.*
- ***Apply Key Criteria*** *– The highest-ranked criteria (Performance on Vasco, 26%) are used for evaluating the creative ideas. Cost (construction and O&M) is included as a key criterion even if not highly ranked. Other criteria (maintenance) are included in the evaluation discussion but are not individually ranked.*

The complete list of weighted criteria is used for evaluating developed ideas using the Weighted Comparison Matrix (see pages 6.18-6.20).

EVALUATIVE CRITERIA MATRIX

The evaluative criteria matrix was used to determine the key evaluative criteria for the project. The VA team listed, with the assistance of the stakeholders, the possible evaluative criteria that could be used to evaluate the creative ideas. These criteria were entered onto a matrix and compared in pairs, asking the question: "Which one is more important to the project?" The letter code (e.g., "a") was entered into the matrix for each pair. When the VA team considered the pair of criteria to be essentially equal in importance, both letters (e.g., "a/b") were entered into the appropriate box. When all pairs were discussed they were tallied and percentages calculated. The highest scoring criteria were selected for use in the Evaluation Phase of the study.

For this project the following evaluative were selected using the paired comparison matrix on the following page:

- Cost (Construction and O&M)
- Vasco Performance
- Freeway Performance
- Right-of-Way/Access

EVALUATIVE CRITERIA MATRIX

Vasco Road / I-580 Interchange

Caltrans

								TOTAL	%
Construction Cost	**A**	a	a	d	e	f	a	3.0	14.0
Maintenance Cost	**B**	c	d	e	f	b/g		0.5	3.0
Design & Construction Schedule	**C**	d	e	c/f	g			1.5	7.0
Performance on Vasco	**D**	d/e	d	d				5.5	26.0
Performance on Freeway	**E**	e	e					5.5	26.0
Right-of-Way / Access	**F**	f						3.5	17.0
Maintenance	**G**							1.5	7.0
								21.0	100.0

a	Greater Importance
a/b	Equal Importance

Bold = Selected Key Criteria

WEIGHTED COMPARISON MATRIX

The weighted comparison matrix compares competing alternatives by applying the weighted evaluative criteria in a matrix to yield value ratios. VA alternatives are compared to the original concept for the full range of criteria to reach a judgment about their technical feasibility as well as their acceptability to stakeholders. The matrix is especially useful for summarizing the results of the VA study and as an exhibit in the team presentation.

This technique is an all-inclusive and objective means of comparing competing alternatives; it avoids using a single criterion, such as initial cost or schedule, to judge a new concept. The Weighted Comparison Matrix is used with the VA team alone or with the stakeholders present. It can be used at any time during the study to rank sets of ideas.

Comparing the total weighted criteria suggests which alternatives are potentially as good as, or better than, the original concept in terms of functionality. Comparison at the value ratio level suggests which alternatives have the best functionality per unit cost, or the most "bang for the buck".

Weighted Comparison Matrix. *The example Weighted Comparison Matrix illustrates the technique of ranking competing alternatives:*

- ***Evaluative Criteria*** *– The criteria developed from the Evaluative Criteria Matrix; may include 0% design criteria at 5% weight*
- ***Weight of Importance*** *– Percentage from Evaluative Criteria Matrix; may be rounded to the nearest 5%*
- ***Alternatives*** *– Original or Baseline Concept, followed by VA Alternative(s) (Caution: alternatives must be equivalent in scope to the original; comparing a road to a structure is not meaningful.)*
- ***Rank*** *– Based on a 1 to 10 scale; select best alternative and assign 10; rank others at different numbers (9 to 1) for forced ranking*
- ***Weighted Score*** *– Multiply Weight by Rank*
- ***Total Weighted Criteria*** *– Summation of weighted scores: Comparison at this level points to functionally strong and weak alternatives*
- ***Estimated Cost/LCC*** *– Approximate initial project cost or life cycle cost(in $ million)*
- ***Value Ratio*** *– Total Criteria divided by Cost/LCC (dimensionless); comparison at this level points to better and lesser value alternatives*

WEIGHTED COMPARISON MATRIX

A weighted comparison matrix was used to compare the original design concepts with VA alternative concepts. Using the evaluative criteria developed by the VA team, the design concepts were ranked on a scale of 1 to 10 and scored by multiplying the weightings. The resulting matrix (see following page) gives total criteria and value ratio (criteria/cost) numbers.

The result of the analysis is that the VA alternatives for Alternative H score higher in weighted criteria (985 vs. 855 points). The value ratio (40 vs. 31) also is higher, suggesting that the VA alternatives can improve performance (and accommodate BART in the median) while reducing cost.

If BART is not accommodated and the existing bridge is widened, the performance is nearly the same as Alternative H (880 vs. 855 points), and the value ratio (36 vs. 31) is better, suggesting that widening the existing bridge is a viable design option.

WEIGHTED COMPARISON MATRIX *Vasco Road / I-580 Interchange*						Caltrans	
Evaluative Criteria	**Weight of Importance**	**Baseline**		**Alternatives MA-7, WF-9, WF-18, WV-1**		**VA Alternative Existing Bridge (AB-1)**	
		Rank	**Score**	**Rank**	**Score**	**Rank**	**Score**
Construction Cost	15	8	120	10	150	10	150
Operations & Maintenance Cost	5	10	50	9	45	8	40
Design & Construction Schedule	5	8	40	10	50	10	50
Vasco Performance	25	9	225	10	250	9	225
Freeway Performance	25	8	200	10	250	8	200
Right-of-Way/Access	15	8	120	10	150	9	135
Maintenance	10	10	100	9	90	8	80
Total Weighted Criteria	**100**		855		985		880
Estimated Cost ($ Million)			27.8		24.5		24.5
Value Ratio = Criteria/Cost			31		40		36
Estimated LCC ($ Million)			-		-		-
Value Ratio = Criteria/LCC			-		-		-

HIGHWAY USER LIFE CYCLE BENEFIT–COST ANALYSIS

The Highway User Life Cycle Benefit-Cost Analysis is used to compare the project costs versus the impacts to the motoring public. The Caltrans Economic Analysis Group developed this model, based on FHWA guidelines, for assessing these user benefits. The highway users are impacted when highway design changes occur that affect user travel time and safety.

Model variables include average speed, length of route, traffic volumes, and accident rates. Current conditions are determined based on traffic studies and accident data, which are generally summarized in the Project Study Report or Project Scope Study Report. Estimates for the impact of these key variables for the various VA alternatives are developed using traffic models and/or engineering estimates. Costs include the initial costs, subsequent costs, such as maintenance/operations and rehabilitations, and any other costs associated with the facility.

Highway User Life Cycle Benefit-Cost Analysis. *The Highway User Life Cycle Benefit-Cost Analysis summary gives an overview analysis and summarizes the results for the project. The example Highway User Life Cycle Benefit-Cost Analysis displays the printout from the computer program for a new facility compared to the existing facility.*

*The **INPUT DATA** required for the 20-year analysis:*

- ***Traffic Data***
  - *Average Daily Traffic (Base and Forecast Years)*
  - *Percent Truck Traffic (With/Without Project)*
  - *Segment Length*
  - *Average Vehicle Operating Speed (With/Without Project)*
- ***Economic Assumptions***
  - *Inflation/Discount Rates (Standard)*
  - *User Costs (From Tables; With/Without Project)*
- ***Accident Data and Costs (Three Years)***
  - *Fatal Accidents*
  - *Injury Accidents*
  - *Property Damage Accidents*
  - *Accident Rates (With/Without Project)****Project Costs***
  - *Initial Costs*
    - *Engineering*
    - *Right of Way*
    - *Construction*
  - *Subsequent Costs*
    - *Maintenance and Operation*
    - *Rehabilitation*
  - *Mitigation Costs*
  - *Other Costs*

Most of the input data required to run this program are part of the project documentation to be provided to the VA team. However, the traffic and accident data, as well as the maintenance and operation costs for the particular highway, may need to be found elsewhere because they are often not included in Project Reports. All other data are more readily available or are generated by the VA team during the study, or are taken from look-up tables that are part of the software.

*The **OUTPUT DATA** produced for the 20-year analysis:*

- ***Travel Time Savings***
  - *Average Annual Traffic*
  - *Total Travel Time*
  - *Travel Time Reduction*
- ***Vehicle Operating Cost Savings***
  - *Annual Vehicle Miles*
  - *Total Vehicle*
  - *VOC Savings*
- ***Accident Cost Savings***
  - *Annual Vehicle Miles*
  - *Annual Number of Accidents*
  - *Total Accident Reduction*
- ***Net Present Value***
  - *Present Value of User Savings*
    - *Travel Time Savings*
    - *Vehicle Operating Savings*
    - *Accident Cost Savings*
  - *Total Savings: Present Value*
  - *Total Costs: Present Value*
  - *Net Present Value*
- ***Internal Rate of Return on Investment***
  - *Project Costs and User Savings*
    - *Total Costs*
    - *Travel time Savings*
    - *Vehicle Operating Cost Savings*
    - *Accident Cost SavingsTotal Benefits*
    - *Annual Returns on Investment*
  - ***Total Benefits***
  - ***Annual Returns on Investment***

*The **Investment Analysis Summary Results** on the first page reports:*

- ***Life Cycle Costs (mil $)***
- ***Life-Cycle Benefits (mil $)***
- ***Net Present Value (mil $)***
- ***Benefit/Cost Ratio***
- ***Rate of Return on Investment (%)***

HIGHWAY USER LIFE CYCLE BENEFIT-COST ANALYSIS

A Highway User Life Cycle Benefit-Cost Analysis using a model provided by Caltrans calculates the 20-year benefits and costs of highway projects. Input data, including traffic, accident and construction, plus subsequent costs, result in calculations for travel time, vehicle operating, and adjacent savings. The net percent value and internal rate of return are used to financially evaluate highway projects.

The Highway User Life Cycle Benefit-Cost Analysis for the Hypothetical Highway Lane Addition Project calculates a benefit-cost ratio of 2.3 and a rate of return on investment of 16.2%.

District:

PROJECT: **A Hypothetical Highway Lane Addition Project**

EA:
PPNO:

1 TRAFFIC DATA

Average Daily Traffic

	w/o Project	w/ Project
Base Year (Year 0)	35,000	
Forecast (Year 20)	70,000	75,000
Percent Truck Traffic	10%	10%

Segment Length (miles)

Existing	New
5.0	5.0

Average Vehicle Operating Speed (mph)

Existing Facility:	w/o Project	
Base Year (Year 0)	45	
Forecast (year 20)	35	
New Facility:		w/ Project
Initial year (Year 1)		65
Forecast (year 20)		60

2 ACCIDENT DATA & COSTS

3-Year Accident Data for Facility

	Count (No.)	Avg. Cost per Accident
Fatal Accidents	2	$2,920,000
Injury Accidents	35	$110,000
Property Damage Accidents	50	$6,400
Avg. Cost / Accident for Facility:		$115,057

Accident Rates (per million vehicle-miles)

	Without Project	
Statewide Avg. for Same Rd. Class	0.80	
Actual Rate on Existing Segment	0.90	
Adjustment Factor (AF= Actual /Avg.)	1.13	
New Facility:		With Project
Statewide Average for Same Rd. Class		0.56
Adjusted Avg. Rate (Avg. (x) AF)		0.63

3 ECONOMIC ASSUMPTIONS

General

Inflation Rate	3.00%
Discount Rate	7.75%
Real Discount Rate	4.75%

User Costs

Value of Travel Time ($/minute) - Autos:	$0.16
Value of Travel Time ($/minute) - Trucks:	$0.40

Use Lookup Table on Page 2:	Existing	New
Unit Operating Cost (Autos)	$0.18	$0.185
Unit Operating Cost (Trucks)	$0.36	$0.475

4 INVESTMENT ANALYSIS

SUMMARY RESULTS

Life-Cycle Costs (mil. $)	**$48.8**
Life-Cycle Benefits (mil. $)	**$112.4**
Net Present Value (mil. $)	**$63.6**
Benefit / Cost Ratio:	**2.3**
Rate of Return on Investment:	**16.2%**

ENTER ALL PROJECT COSTS (IN TODAY'S DOLLARS) IN COLUMNS 1-7 BELOW:

PROJECT COSTS

Col. no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Direct Project Costs								
Year	INITIAL COSTS			SUBSEQUENT COSTS		Mitigation Costs	Other Costs	TOTAL COSTS	
	Project Support	R / W	Construction	Maint./Op.	Rehab.			Constant Dollars	Present Value
All prior									
Base	$1,500,000	$8,500,000	$15,000,000					$25,000,000	$25,000,000
1			20,000,000			2,500,000		22,500,000	21,479,714
2								0	0
3								0	0
4								0	0
5				500,000				500,000	396,460
6								0	0
7								0	0
8								0	0
9								0	0
10				750,000				750,000	471,543
11								0	0
12								0	0
13								0	0
14								0	0
15				1,000,000				1,000,000	498,528
16								0	0
17								0	0
18								0	0
19								0	0
20					2,500,000			2,500,000	988,233
Total	$1,500,000	$8,500,000	$35,000,000	$2,250,000	$2,500,000	$2,500,000	$0	$52,250,000	$48,834,478

$$\text{Present Value} = \frac{\text{Future Value (in Constant Dollars)}}{(1 + \text{Real Discount Rate})^{\text{Year}}}$$

TRAFFIC DATA FROM PAGE 2 IS UTILIZED HERE TO CALCULATE OCCUPANTS' TRAVEL TIME SAVINGS.

TRAVEL TIME SAVINGS

Col. no.	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Year	Average Annual Traffic (vehicles/yr) Existing Facility	Average Annual Traffic (vehicles/yr) New Facility	Total Travel Time (hours/yr) Existing Facility	Total Travel Time (hours/yr) New Facility	Travel Time Reduction	Travel Time Savings Constant Dollars	Travel Time Savings Present Value
Base	**12,775,000**	**12,775,000**					
1	13,413,750	13,505,000	1,507,163	1,042,857	464,306	$5,125,936	$4,893,495
2	14,052,500	14,235,000	1,596,875	1,103,488	493,387	5,446,988	4,964,190
3	14,691,250	14,965,000	1,688,649	1,164,591	524,058	5,785,600	5,033,688
4	15,330,000	15,695,000	1,782,558	1,226,172	556,386	6,142,504	5,101,870
5	15,968,750	16,425,000	1,878,676	1,288,235	590,441	6,518,471	5,168,631
6	16,607,500	17,155,000	1,977,083	1,350,787	626,296	6,914,307	5,233,889
7	17,246,250	17,885,000	2,077,861	1,413,834	664,027	7,330,863	5,297,572
8	17,885,000	18,615,000	2,181,098	1,477,381	703,717	7,769,031	5,359,628
9	18,523,750	19,345,000	2,286,883	1,541,434	745,448	8,229,751	5,420,014
10	19,162,500	20,075,000	2,395,313	1,606,000	789,313	8,714,010	5,478,703
11	19,801,250	20,805,000	2,506,487	1,671,084	835,403	9,222,849	5,535,677
12	20,440,000	21,535,000	2,620,513	1,736,694	883,819	9,757,365	5,590,931
13	21,078,750	22,265,000	2,737,500	1,802,834	934,666	10,318,713	5,644,469
14	21,717,500	22,995,000	2,857,566	1,869,512	988,054	10,908,112	5,696,304
15	22,356,250	23,725,000	2,980,833	1,936,735	1,044,099	11,526,849	5,746,457
16	22,995,000	24,455,000	3,107,432	2,004,508	1,102,924	12,176,284	5,794,957
17	23,633,750	25,185,000	3,237,500	2,072,840	1,164,660	12,857,852	5,841,843
18	24,272,500	25,915,000	3,371,181	2,141,736	1,229,445	13,573,073	5,887,157
19	24,911,250	26,645,000	3,508,627	2,211,203	1,297,423	14,323,555	5,930,949
20	**25,550,000**	**27,375,000**	3,650,000	2,281,250	1,368,750	15,111,000	5,973,276
Total							**$109,593,700**

Avg. Annual Traffic = Avg. Daily Traffic x 365 days — vehicles / yr

Avg. Value of Time = (%Autosx$0.15+%Trucksx$0.39)x60 minutes

Travel Time = (Avg. Annual Traffic) (segment length) / speed

vehicle-hrs / yr — vehicles / yr x miles — miles/hour

Delay Savings = Travel Time Reduction x Avg. Value of Time

$ / year — $/hour

TRAFFIC PROJECTIONS FROM PAGE 4 ARE UTILIZED HERE TO CALCULATE VOC SAVINGS.

VEHICLE OPERATING COST SAVINGS

Col. no.	(17)	(18)	(19)	(20)	(21)	(22)	(23)
Year	Annual Vehicle Miles of Travel		Total Vehicle Operating Cost ($)		VOC Savings	Vehicle Operating Cost Savings	
	Existing Facility	New Facility	Existing Facility	New Facility		Constant Dollars	Present Value
Base	63,875,000	63,875,000					
1	67,068,750	67,525,000	$13,279,613	$14,450,350	($1,170,738)	($1,170,738)	($1,117,649)
2	70,262,500	71,175,000	$13,911,975	$15,231,450	(1,319,475)	(1,319,475)	(1,202,522)
3	73,456,250	74,825,000	$14,544,338	$16,012,550	(1,468,213)	(1,468,213)	(1,277,400)
4	76,650,000	78,475,000	$15,176,700	$16,793,650	(1,616,950)	(1,616,950)	(1,343,014)
5	79,843,750	82,125,000	$15,809,063	$17,574,750	(1,765,688)	(1,765,688)	(1,400,050)
6	83,037,500	85,775,000	$16,441,425	$18,355,850	(1,914,425)	(1,914,425)	(1,449,153)
7	86,231,250	89,425,000	$17,073,788	$19,136,950	(2,063,163)	(2,063,163)	(1,490,923)
8	89,425,000	93,075,000	$17,706,150	$19,918,050	(2,211,900)	(2,211,900)	(1,525,925)
9	92,618,750	96,725,000	$18,338,513	$20,699,150	(2,360,638)	(2,360,638)	(1,554,687)
10	95,812,500	100,375,000	$18,970,875	$21,480,250	(2,509,375)	(2,509,375)	(1,577,703)
11	99,006,250	104,025,000	$19,603,238	$22,261,350	(2,658,113)	(2,658,113)	(1,595,435)
12	102,200,000	107,675,000	$20,235,600	$23,042,450	(2,806,850)	(2,806,850)	(1,608,314)
13	105,393,750	111,325,000	$20,867,963	$23,823,550	(2,955,588)	(2,955,588)	(1,616,745)
14	108,587,500	114,975,000	$21,500,325	$24,604,650	(3,104,325)	(3,104,325)	(1,621,103)
15	111,781,250	118,625,000	$22,132,688	$25,385,750	(3,253,063)	(3,253,063)	(1,621,743)
16	114,975,000	122,275,000	$22,765,050	$26,166,850	(3,401,800)	(3,401,800)	(1,618,990)
17	118,168,750	125,925,000	$23,397,413	$26,947,950	(3,550,538)	(3,550,538)	(1,613,153)
18	121,362,500	129,575,000	$24,029,775	$27,729,050	(3,699,275)	(3,699,275)	(1,604,516)
19	124,556,250	133,225,000	$24,662,138	$28,510,150	(3,848,013)	(3,848,013)	(1,593,345)
20	127,750,000	136,875,000	$25,294,500	$29,291,250	(3,996,750)	(3,996,750)	(1,579,888)
Total							**($30,012,258)**

$11.04 /hour

Annual Vehicle Miles of Travel = (Avg. Daily Traffic) (365) (Segment Length)

(miles)

Total Vehicle Operating Cost = (Annual VMT) [% Auto (Unit VOC for Cars) + % Trucks (Unit VOC for Trucks)]

($ / vehicle-mile)

ACCIDENT DATA & COSTS FROM PAGE 2 ARE USED HERE TO CALCULATE ACCIDENT COST SAVINGS.

ACCIDENT COST SAVINGS

Col. no.	(24)	(25)	(26)	(27)	(28)	(29)	(30)
From:	p. 6 (17)	p. 6 (18)					

Year	Annual Vehicle Miles of Travel		Annual Number of Accidents			Accident Cost Savings	
	Existing Facility	New Facility	Existing Facility	New Facility	Total Accident Reduction	Constant Dollars	Present Value
Base	63,875,000	63,875,000	57				
1	67,068,750	67,525,000	60	43	18	$2,050,454	$1,957,474
2	70,262,500	71,175,000	63	45	18	2,116,597	1,928,991
3	73,456,250	74,825,000	66	47	19	2,182,741	1,899,066
4	76,650,000	78,475,000	69	49	20	2,248,885	1,867,889
5	79,843,750	82,125,000	72	52	20	2,315,028	1,835,634
6	83,037,500	85,775,000	75	54	21	2,381,172	1,802,464
7	86,231,250	89,425,000	78	56	21	2,447,316	1,768,527
8	89,425,000	93,075,000	80	59	22	2,513,459	1,733,962
9	92,618,750	96,725,000	83	61	22	2,579,603	1,698,895
10	95,812,500	100,375,000	86	63	23	2,645,747	1,663,443
11	99,006,250	104,025,000	89	66	24	2,711,890	1,627,713
12	102,200,000	107,675,000	92	68	24	2,778,034	1,591,802
13	105,393,750	111,325,000	95	70	25	2,844,178	1,555,802
14	108,587,500	114,975,000	98	72	25	2,910,321	1,519,793
15	111,781,250	118,625,000	101	75	26	2,976,465	1,483,851
16	114,975,000	122,275,000	103	77	26	3,042,609	1,448,043
17	118,168,750	125,925,000	106	79	27	3,108,752	1,412,432
18	121,362,500	129,575,000	109	82	28	3,174,896	1,377,073
19	124,556,250	133,225,000	112	84	28	3,241,040	1,342,016
20	127,750,000	136,875,000	115	86	29	3,307,183	1,307,307
Total							**$32,822,177**

Annual Number of Accidents = (Annual Vehicle Miles of Travel) (accident rate) / 10^6

accidents / yr — vehicles-miles/year /1,000,000 — accidents per million vehicles

Accident Cost Savings = Accidents Reduced/year (x) Avg. Cost per Accident

DISCOUNTED SAVINGS (BENEFITS) ARE SUMMARIZED HERE TO CALCULATE NET PRESENT VALUE OF PROJECT.

NET PRESENT VALUE

	(31)	(32)	(33)	(34)	(35)	(36)
From:	p. 5 (16)	p. 6 (23)	p. 7 (30)		p. 4 (9)	
Year	Present Value of User Savings (Benefits)			Total Savings: Present Value	Total Costs: Present Value	NET PRESENT VALUE
	Travel Time Savings	Vehicle Operating Cost Savings	Accident Cost Savings			
Base					$25,000,000	($25,000,000)
1	$4,893,495	($1,117,649)	$1,957,474	$5,733,319	$21,479,714	($15,746,394)
2	4,964,190	(1,202,522)	1,928,991	5,690,659	0	5,690,659
3	5,033,688	(1,277,400)	1,899,066	5,655,355	0	5,655,355
4	5,101,870	(1,343,014)	1,867,889	5,626,745	0	5,626,745
5	5,168,631	(1,400,050)	1,835,634	5,604,215	396,460	5,207,755
6	5,233,889	(1,449,153)	1,802,464	5,587,200	0	5,587,200
7	5,297,572	(1,490,923)	1,768,527	5,575,176	0	5,575,176
8	5,359,628	(1,525,925)	1,733,962	5,567,665	0	5,567,665
9	5,420,014	(1,554,687)	1,698,895	5,564,222	0	5,564,222
10	5,478,703	(1,577,703)	1,663,443	5,564,443	471,543	5,092,900
11	5,535,677	(1,595,435)	1,627,713	5,567,955	0	5,567,955
12	5,590,931	(1,608,314)	1,591,802	5,574,420	0	5,574,420
13	5,644,469	(1,616,745)	1,555,802	5,583,526	0	5,583,526
14	5,696,304	(1,621,103)	1,519,793	5,594,993	0	5,594,993
15	5,746,457	(1,621,743)	1,483,851	5,608,565	498,528	5,110,037
16	5,794,957	(1,618,990)	1,448,043	5,624,010	0	5,624,010
17	5,841,843	(1,613,153)	1,412,432	5,641,122	0	5,641,122
18	5,887,157	(1,604,516)	1,377,073	5,659,714	0	5,659,714
19	5,930,949	(1,593,345)	1,342,016	5,679,620	0	5,679,620
20	5,973,276	(1,579,888)	1,307,307	5,700,695	988,233	4,712,462
Total	$109,593,700	($30,012,258)	$32,822,177	$112,403,619	$48,834,478	**$63,569,141**

Net Present Value

SAVINGS IN CONSTANT DOLLARS ARE SUMMARIZED HERE TO CALCULATE INTERNAL RATE OF RETURN ON INVESTMENT.

INTERNAL RATE OF RETURN ON INVESTMENT

	(37)	(38)	(39)	(40)	(41)	(42)
From:	p. 4 (8)	p. 5 (15)	p. 6 (22)	p. 7 (29)		

Year	Project Costs & User Savings (in Constant Dollars)					Annual Returns on Investment
	TOTAL COSTS	Travel Time Savings	Vehicle Operating Cost Savings	Accident Cost Savings	TOTAL BENEFITS	
Base	($25,000,000)					($25,000,000)
1	(22,500,000)	$5,125,936	($1,170,738)	$2,050,454	$6,005,652	(16,494,348)
2	0	5,446,988	(1,319,475)	2,116,597	6,244,111	6,244,111
3	0	5,785,600	(1,468,213)	2,182,741	6,500,129	6,500,129
4	0	6,142,504	(1,616,950)	2,248,885	6,774,439	6,774,439
5	(500,000)	6,518,471	(1,765,688)	2,315,028	7,067,811	6,567,811
6	0	6,914,307	(1,914,425)	2,381,172	7,381,054	7,381,054
7	0	7,330,863	(2,063,163)	2,447,316	7,715,016	7,715,016
8	0	7,769,031	(2,211,900)	2,513,459	8,070,591	8,070,591
9	0	8,229,751	(2,360,638)	2,579,603	8,448,716	8,448,716
10	(750,000)	8,714,010	(2,509,375)	2,645,747	8,850,382	8,100,382
11	0	9,222,849	(2,658,113)	2,711,890	9,276,627	9,276,627
12	0	9,757,365	(2,806,850)	2,778,034	9,728,549	9,728,549
13	0	10,318,713	(2,955,588)	2,844,178	10,207,303	10,207,303
14	0	10,908,112	(3,104,325)	2,910,321	10,714,108	10,714,108
15	(1,000,000)	11,526,849	(3,253,063)	2,976,465	11,250,251	10,250,251
16	0	12,176,284	(3,401,800)	3,042,609	11,817,092	11,817,092
17	0	12,857,852	(3,550,538)	3,108,752	12,416,067	12,416,067
18	0	13,573,073	(3,699,275)	3,174,896	13,048,694	13,048,694
19	0	14,323,555	(3,848,013)	3,241,040	13,716,582	13,716,582
20	(2,500,000)	15,111,000	(3,996,750)	3,307,183	14,421,433	11,921,433
Total	($52,250,000)	$187,753,112	($51,674,875)	$53,576,368	$189,654,605	$162,404,605

Internal Rate of Return **16.21%**

The INTERNAL RATE OF RETURN (IRR) is the discount rate at which benefits and costs break even (are equal). For a project with an IRR greater than the Discount Rate, benefits are greater than costs, and the project has a positive economic value. The IRR allows us to compare projects which have very different costs, and very different benefit flows, and different time periods.

Project Description

PROJECT DESCRIPTION

The Project Description section of the report presents a summary of the study project so that the reader does not need to locate other project documents to understand the scope of the VA study. It is a digest of the project scope, schedule and budget. Also, it includes the list of project data used by the VA team during the study and selected key drawings.

Project Description. *The example Project Description section includes four topics:*

- ***Introduction*** *– Summarizes the project scope, need and purpose, schedule, and budget. List expense authorization, County Route, and Postmiles (Kilometer Posts).*
- ***Project Description*** *– Expands on the specific features of the project and discusses significant issues and concerns about the project scope, schedule or budget (including type of funds). Also indicates major project elements, design speed, projected traffic (DHV and ADT), route conditions (adjacent segments and overall routes).*
- ***Information Provided to the VA Team*** *– A listing of the project data provided to the team for use during the study, noting the name of the document and the source and date.*
- ***Key Drawings*** *– Selected drawings that support the project description and help identify the project scope. Typical drawings are:*
  - *Site Plan*
  - *Alternative Levels of Service*
  - *Intersection Geometrics*
  - *Proposed Layouts*
  - *Typical Cross Sections*

PROJECT DESCRIPTION

INTRODUCTION

The modifications of the existing Vasco Road Interchange on Interstate 580 in Livermore in Alameda County: 4-256-23810K-ALA-580-PM9.3/10.1. It will be accomplished in two phases: an interim minimum operational improvement project, the Minimum Project Alternative (MPA); and an ultimate interchange reconstruction project.

The purpose of the MPA is to improve operations on Vasco Road and to accommodate traffic from the existing commercial development in the southern area adjacent to the interchange. The estimated cost of the project is $5,000,000, funded by the City of Livermore.

The Ultimate Project is to improve operations and increase capacity to the interchange by the year 2020 to accommodate future land use development and increase in traffic. A widened median for an extension of the Bay Area Rapid Transit District (BARTD) line from Dublin/Pleasanton also will be provided. The estimated cost of this Ultimate Project is $27,794,000.

PROJECT DESCRIPTION

The proposed project is located at the Vasco Road Interchange on Interstate 580 in eastern Livermore in Alameda County. Within the project limits, I-580 is an eight-lane freeway with a 36-foot median and 10-foot outside shoulders. The I-580/Vasco Road Interchange is located between the First Street (Route 84) Interchange to the west and Greenville Road Interchange to the east. There are truck weigh stations located on both eastbound and westbound I-580 between Vasco Road and Greenville road interchanges.

Vasco Road is a major arterial providing access for the entire northeastern area of the City of Livermore. It provides the most direct access to and from I-580 for the Lawrence Livermore National Laboratory, an employer of national significance in the region, for the residential areas in eastern Livermore, and for the commercial and industrial development along Vasco Road. Approaching the project limits, Vasco Road is currently a two-lane arterial. Within the vicinity of the project limits, Vasco Road has been widened to four lanes with bicycle lanes and left-turn channelization at intersections.

The proposed MPA project includes the following improvements:

- Construct an auxiliary lane in each direction on I-580 between Vasco Road and 1st Street (Route 84) interchanges.
- Realign and widen the eastbound diagonal off-ramp to southbound Vasco Road from one to two lanes.
- Realign the eastbound loop off-ramp to northbound Vasco Road.
- Slight revision at Vasco Road to the on-ramp to eastbound I-580.

- Construct a signalized intersection at the ramp termini at Vasco Road.
- Realign the segment of Southfront Road paralleling Vasco Road to a location further west, in order to create sufficient space for realignment of the eastbound off-ramp, and to increase the distance between the Preston Avenue/Southfront road and Preston Avenue/Vasco Road intersections.
- Add an additional lane in each direction on Vasco road from Northfront Road to Las Positas by restriping the existing roadway.

The emphasis of the MPA is to retain the basic three-loop configuration of the interchange, while making relatively minor revisions to improve capacity and safety.

Alternative H (selected as the baseline design for the VA study), which involves the construction of a half-diamond, half-cloverleaf interchange at this location, includes the following modifications:

- Eliminate the existing ramps in the southern half of the interchange and construct a diamond on-ramp and off-ramp.
- Eliminate the existing loop ramp in the northwest quadrant and construct a new diagonal on-ramp and collector road.
- Realign the exiting loop on-ramp and the diagonal off-ramp in the northeast quadrant to form half a cloverleaf interchange in the northern half of the interchange.
- Realign the existing south frontage road (along I-580) to accommodate the new ramp alignment in the southwest quadrant of the interchange.
- Realign existing Vasco road, including the overcrossing over I-580 to the west.
- Construct a new Vasco Road overcrossing.
- Widen the I-580 freeway median for BARTD.
- Construct two new diagonal on-ramps in the northwest and southeast quadrants.

INFORMATION PROVIDED TO THE VA TEAM

The following project documents were provided to the VA team for their use during the study:

- Project Study Report, I-580/Vasco Road Interchange Modifications, September 1998, by URS Greiner:
  - Introduction
  - Plans and Profiles
  - Project Cost Estimates (Alternative H, A, MPA)
  - Traffic Operations Analysis
- Vasco Road/I-580 Alternatives Analysis, March 1997, by URS Greiner:
  - Alternatives A(E), A(W), B, C, D, E, F, G, H, J
  - Menu of Interim Improvements 1-9
- Vasco Road/I-580 Interchange Environmental Constraints by Daniel J. Powers, August 1997
- Preliminary Geotechnical Study, Improvements to Vasco Road/I-580 Interchange, by Kleinfelder, August 1997
- Initial Site Assessment Report, I-580/Vasco Road Interchange, by Kleinfelder, August 1997
- Bay Area Regional Transportation Strategy for the year 2020, Caltrans 1991
- Project Study Report, I-580, 0.6 Miles East of Greenville to 0.9 Miles East of Vasco, Caltrans, 1993
- Ramp Meter Development Plan, District 4, Caltrans 1997
- Route Concept Report, Route I-580, ALA 0.7 to MRN 2.31, Caltrans, 1985
- Maintenance Data, ALA-580, 009-010, by Caltrans, September 1998

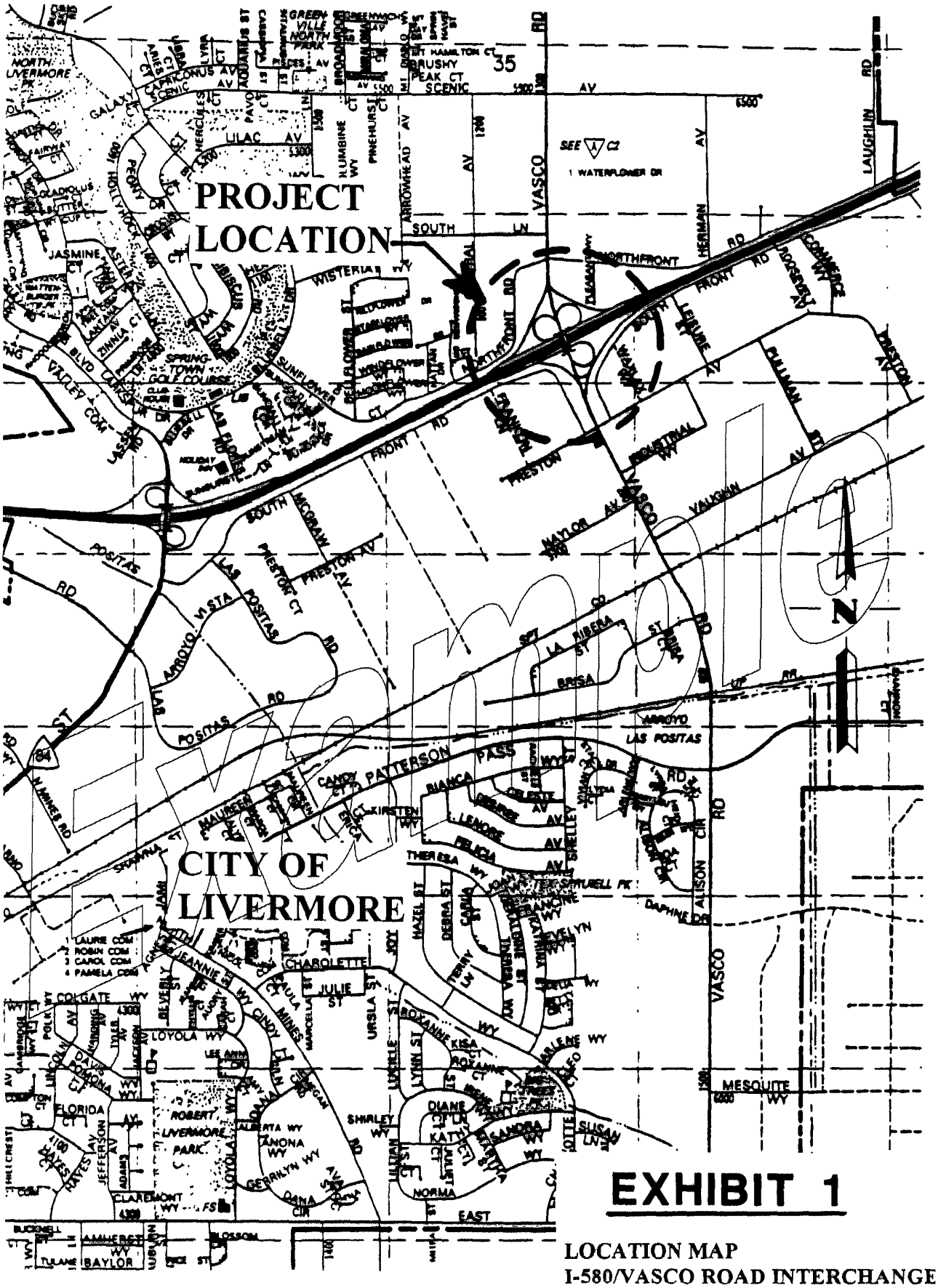


EXHIBIT 1

LOCATION MAP
I-580/VASCO ROAD INTERCHANGE

PROJECT INFORMATION

Information about the study project, the VA team, and initial analyses are recorded on the following forms:

Study Identification. *The example Study Identification form documents the essential descriptions for the project and the VA team members. See VA Team Guide for instructions.*

Lessons Learned. *The example Lessons Learned summarizes comments from the project briefings and the site visits, as recorded on the Project Information forms (see VA Team Guide).*

Project Constraints/Paradigm Shifts. *The example Project Constraints and Paradigm Shifts lists the project boundaries as perceived by the VA team and noted on the Project Information form (see VA Team Guide for instructions).*

STUDY IDENTIFICATION *Widen SR 73 Freeway and Modify I-405 Interchanges*				Caltrans		
PROJECT LOCATION District 12, Costa Mesa, California				**STUDY DATES:** 3/30 to 4/10/98		
ROUTE SR 73	**PM (KP)** 3.6-3.9	**CHARGING INFORMATION**	**EA** 120611	**FA** 1	**AO** 185	**MSA** P1520

VA TEAM MEMBERS

NAME	TITLE	ORGANIZATION	PHONE / FAX	
Graham Fraser	Drainage	Fraser Engineering, Inc.	760	722-3495
			760	722-3490
Lisa Alviso	Design/Structures	Caltrans	714	724-2958
			714	724-2591
Derich Sukow	Design/Roadway	Caltrans	714	724-7688
			714	756-7688
Barbara Gossett	Environmental Planning	Caltrans	714	724-2224
			714	724-2592
Tak Sorida	Traffic Operations	Caltrans	714	724-2352
Hossain Mansouri	Construction	Caltrans	714	556-2031
			714	556-0788
Rahim Monajemi	Maintenance	Caltrans	714	724-2603
			714	556-0788

PROJECT DESCRIPTION

LENGTH	COST	TYPE OF FUNDS
3.6 KM + 3.9 KM	$57,180,000	Integrated Funding Plan

PROJECT PHASE/PROJECT MILESTONE: Design/Milestone 220

MAJOR PROJECT ELEMENTS

The proposed project is composed of four interrelated components: (1) Widening of SR 73 with one HOV lane and one mixed-flow lane in each direction, and adding auxiliary lanes near the SR 55 interchange; (2) Constructing a new Connector B from northbound SR 73 and southbound SR 55; (3) Adding operational improvements to I-405 between Bear and Euclid Street, including auxiliary lanes, realignment of local access ramps, and widening the SR 73/I-405 interchange; and (4) Widening the Euclid Street northbound off-ramp from I-405.

DESIGN SPEED	PROJECTED TRAFFIC	PROJECTED AWARD DATE
65 mph	**ADT** 288,000 **DHV**	Not scheduled

ROUTE CONDITIONS

ADJACENT SEGMENTS	OVERALL ROUTE
San Joaquin Hills Transportation Corridor – 1997 completion. I-405/Route 55 Transitway – in design.	I-405 Freeway – Access/improvements programmed.

PROJECT INFORMATION *Vasco Road/I-580 Interchange*	**Caltrans**
TEAM MEMBER: Heidi Ouren	**DATE:** October 5, 1998

PROJECT BRIEFING(S):

Scott Kelsey of URS Greiner presented an overview of the design effort to date. He listed several concerns: validate Alternative H; review minimum project alternative; reduce cost; reduce schedule; review staged construction.

SITE VISIT(S):

Dan Smith of the City of Livermore gave a guided tour of the project site. He noted the local concerns about north-south travel at commute hours on Vasco Road and the impact of widening on local businesses.

PROJECT CONSTRAINTS:

Existing weigh station constrains I-580 widening; right-of-way limits design options; interim schedule is urgent.

PARADIGM SHIFTS:

Allow Preston Avenue location to change; challenge the accommodation of BART median improvements.

LESSONS LEARNED – SITE VISIT

- Devoid of sensitive habitats
- Visualized the land uses, commercial and residential
- Few residential relocations needed
- Potential development of the area
- Looks like we could reuse the existing bridge
- Probably no full takes of right-of-way
- New bridge will be higher and ramps will be higher
- Sight distance on Vasco now poor
- Tight diamond looks feasible except for west movement (three left turns)
- South side has congestion and most difficult problems with traffic flow
- More of a regional interchange than a Livermore interchange.

PARADIGMS AND CONSTRAINTS

- Existing weight station to east constrains design for widening I-580
- Maintaining the location of Preston Avenue limits local street geometrics
- Budget for interim (MPA) work is limited to $5,000,000
- Schedule for interim (MPA) work is urgent
- Accommodation of BART in median constrains design of interchange improvements
- Right-of-way limits design options.

Idea Evaluation

IDEA EVALUATION

Introduction

The Idea Evaluation section of the report discusses the procedures used to develop and evaluate the creative ideas, and to document the evaluated and ranked ideas. It is a detailed methodology that forms the basis for an objective, criteria-based evaluation of ideas so that a broad set of key criteria are applied to the ideas rather than a narrow set of only one or two criteria.

Report Text. The Idea Evaluation text provides a summary of the process used to evaluate the creative ideas generated by the VA team.

Idea Evaluation. *The example Idea Evaluation section covers three topics:*

- ***Key Evaluative Criteria*** *– Describes how the listed key evaluative criteria were chosen*
- ***Evaluation Process*** *– Outlines how the VA team discusses each idea separately*
- ***Creative Idea/Evaluation Worksheets*** *– Explains the use of the worksheets*

IDEA EVALUATION

INTRODUCTION

The creative ideas generated by the VA team are carefully evaluated, and project-specific criteria are applied to each idea to assure an objective evaluation.

KEY EVALUATIVE CRITERIA

The VA team used the paired comparison method (see following page) to determine the four key evaluative criteria for this project:

- Construction and O&M Cost ($)
- Vasco Performance (V)
- Freeway Performance (F)
- Right-of-Way/Access (R)

The team enlisted the assistance of the stakeholders and designers (when available) to develop these criteria so that the evaluation would reflect their specific requirements.

EVALUATION PROCESS

The VA team, as a group, generated and evaluated ideas on how to perform the various functions. The idea list was grouped by function. While ideas on the overall project were evaluated as a group, ideas relating to a specific technical discipline may have been evaluated by the responsible team member.

The team compared each of the ideas with the original concept for each of the key evaluative criteria to determine whether it was better, equal to, or worse than the original concept. The team reached a consensus on the ranking of the idea. High-ranked ideas would be developed further; low-ranked ones would be dropped from further consideration.

CREATIVE IDEA AND EVALUATION WORKSHEETS

All of the numerous ideas that were generated during the creative phase using brainstorming techniques were recorded on the following Creative Idea/Evaluation forms. These ideas were discussed and the advantages and disadvantages of each were listed.

The key evaluative criteria (coded, see above) were used to rate each idea on a five-point system with a maximum of a plus two (+2) points and a negative two (-2) points. VA alternatives with a negative two
(-2) points will not be developed or presented unless directed by the client due to very serious budget problems.

Once an idea was fully evaluated, it was given a ranking number, on a scale of 1 to 10. Ideas ranked 7 or higher were developed further and documented on the Creative Idea Evaluation forms. Ideas ranked as a 6 may be written-up as Design Suggestions. Ideas ranked 1 to 5 were not developed further.

All readers are encouraged to review the creative idea listings, because even the low-ranked ideas may suggest additional ideas that can be applied to the design.

CREATIVE IDEAS EVALUATION

The Creative Ideas Evaluation worksheets are used to record the discussions of the VA team during the Evaluation Phase. The documented information shows how the team reached a team consensus about the suitability of an alternative idea and ranked all ideas for further development. The form can be hand written by a team member or entered into a computer database by a staff assistant during the evaluation session.

Creative Ideas Evaluation. *The example Creative Ideas Evaluation worksheet shows how it is used to record the following information:*

- ***Project Name*** *– Pre-printed on the forms*
- ***Function*** *– The verb-noun function that is the focus of the creativity session (Increase Capacity); this may be a discipline (Architectural)*
- ***Idea Number*** *– Alpha-numeric identifier (AB –1 ff)*
- ***Creative Idea*** *– A transcription of the idea as listed in the creative session; as the evaluation proceeds the words may change to reflect new thinking*
- ***Evaluation by Criteria*** *– The key criteria are coded ($ for cost, etc.). The team ratings for each idea, when compared to the original concept, are noted using a five-point system:*
  - *+2 or +1 for improvement*
  - *0 for no change*
  - *-1 or -2 for degradation*
- ***Advantages*** *– Specific ways that the idea improves the original concept*
- ***Disadvantages*** *– Specific ways that the idea degrades the original concept*
- ***Rank*** *– Team consensus based on a scale of 1 to 10:*
  - *10 Technically feasible – the project will benefit greatly. Significant cost and/or significant functional improvements*
  - *9 Technically feasible – will improve the project. Some cost and/or other functional improvements*
  - *8 Technically feasible – minor cost and/or other functional improvements*
  - *7 Could have some project benefits – may challenge design criteria; needs further development.*
  - *6 Alternate approach – possible design suggestion*
  - *5 Cost reduction – some loss in functional requirements*
  - *4 Benefits questionable*
  - *3 Too many unknowns to pursue further*
  - *2 Significant disadvantages*
  - *1 Does not meet program requirements*

CREATIVE IDEAS EVALUATION *Vasco Road / I-580 Interchange*									Caltrans
Function: ACCOMMODATE BART		**IDEA EVALUATION**							
		Criteria				**Advantages**		**Disadvantages**	**Rank**
No.	**Creative Idea**	**$**	**V**	**F**	**R**				
AB-1	Utilize existing structure by widening	+2	+1	0	0	• Improves sight distance • Saves cost • Reduces staging • Improves Vasco performance		• Limits room for BART	8
AB-2	Move columns to accommodate BART	-2	0	0	0	• Retains existing bridge/structure		• Benefits questionable • Increases cost	4
AB-3	Use steel girders in lieu of prestressed box	-2	0	0	0	• Requires less falsework • Helps constructibility		• Needs deeper structural section • Increases cost	4
AB-4	Lengthen existing bridge	+1	-1	0	0	• Reduces cost • Reduces demolition		• Does not improve Vasco performance	7
AB-5	Reduce BART median width	+1	0	0	+1	• Reduces right-of-way take • Reduces cost		• BART approval needed • May delay schedule	8
AB-6	Build new bridge at the same elevation as the existing bridge	0	0	-2	0	• None apparent		• Vertical clearance not increased	2
AB-7	Realign BART to north of I-580 west of Vasco interchange	+2	0	0	+2	• Reduces cost		• BART pays later for right-of-way	6

Ranking Scale: **10-7 = Most Likely to be Developed** **6 = Design Suggestion** **1-5 = Least likely to be developed**

Evaluation Criteria: **Significant Improvement +2, +1, 0, -1, -2 Significant Degradation**

$ = Cost (Construction + O&M) **V = Vasco Performance** **F = Freeway Performance** **R = Right-of-Way/Access**

Value Analysis Process

VALUE ANALYSIS PROCESS

This report section gives an overview of the pre-study preparation, study performed, and post-study implementation activities, and includes the agenda, the study participants and daily attendance sheets. It is a record of the persons participating on the VA team as well as those who assisted during the study. It includes a detailed summary of the VA methodology followed during the study and lists all participants.

Value Analysis Process. *The example Value Analysis Process section summarizes the value methodology:*

- ***Introduction*** *– Introduces the VA procedures used in the study*
- ***Pre-Study Preparation*** *– States the activities done before the formal study began*
- ***Study Performance*** *– Summarizes the six activities within the team study*
- ***Post-Study Implementation*** *– Outlines the three activities following the study*

VA Study Agenda. *The example agenda used in the VA study is a four-day agenda. The specific agenda is tailored to the VA study as needed.*

VA Study Participants. *The example VA study Participants lists the names of the persons involved in the study:*

- ***VA team members*** *– VA team leader, Caltrans staff, consultants*
- ***Stakeholders*** *– Municipal, Regional, Federal agencies*
- ***Design team members*** *– Project development team, consultants*
- ***District Managers*** *– Managers, District VA Coordinator*

Daily Attendance Sheets. *The example daily attendance sheets record the attendance of each person involved in each day of a study.*

VALUE ANALYSIS PROCESS

INTRODUCTION

The Value Analysis process involves twelve activities needed to accomplish a VA study, organized in three parts: pre-study preparation, study performance, and post-study implementation. The following Value Analysis Activity Chart summarizes these activities, which are also described below.

PRE-STUDY PREPARATION

Prior to the start of a VA study, the District VA Coordinator (DVAC) and Team Leader carry out the following three activities:

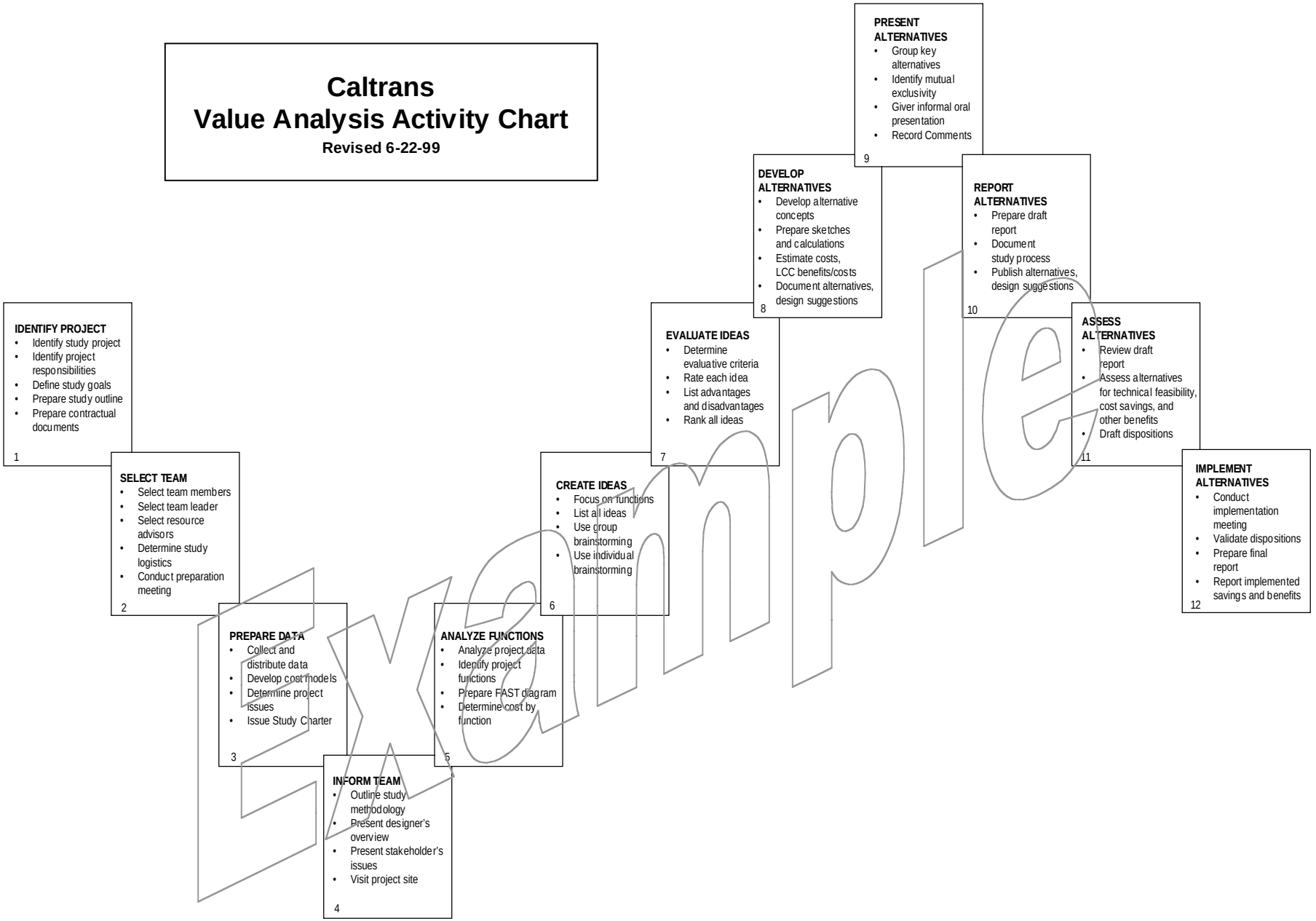
- **Identify Project** – The project is selected and the project stakeholders are identified; the study goals are defined and the study is outlined; contractual documents are prepared if consultants are needed to carry out the study.
- **Select Team** – Team members are selected from both in-house staff and outside consultants; the team leader is chosen, and the resource advisors are identified; the study location and logistics are determined, and a preparation meeting is held to confirm all study details.
- **Prepare Data** – the project data are collected and distributed to the VA team; cost models are developed by the VA team leader and project issues are defined; the VA Study Charter is issued.

STUDY PERFORMANCE

There are six activities carried out by the VA team during the performance of the study:

- **Inform Team** – The VA team leader outlines the study methodology; the designer and other stakeholders make a presentation of the current design to the VA team and the team visits the project site; the VA team reviews project data and summarizes the project issues and study goals.
- **Analyze Functions** – Project functions are identified and a FAST diagram is constructed; the costs of project functions are analyzed.
- **Create Ideas** – All alternative ideas are listed to accomplish project functions; group brainstorming and individual brainstorming are used to maximize the number of creative ideas; judgment of ideas is suspended.
- **Evaluate Ideas** – Project-specific evaluative criteria are determined; each idea is evaluated and ranked; advantages and disadvantages are noted.

Caltrans
Value Analysis Activity Chart
Revised 6-22-99



Pre-Study Preparation | Study Performance | Post-Study Implementation

- **Develop Alternatives** – High-ranked ideas are developed into VA alternatives, with sketches, calculations, initial costs, life cycle costs and benefits; documentation is prepared for alternatives and design suggestions.

- **Present Alternatives** – Key alternatives are grouped by project elements and mutually exclusive alternatives are identified; VA team gives informal oral presentation to designer and stakeholders; management comments are recorded.

POST-STUDY IMPLEMENTATION

Following the VA study, the Team Leader and DVAC carry out the final three activities, in collaboration with the project development team:

- **Report Alternatives** – A draft VA study report is prepared by the VA team leader, documenting the VA study process and the VA alternatives and design suggestions.

- Assess Alternatives – The draft report is reviewed by the design team and stakeholders and the VA alternatives are assessed for technical feasibility, cost savings, and other benefits; dispositions of the alternatives are drafted.

- Implement Alternatives – An implementation meeting is conducted to validate the dispositions of the VA alternatives; the final VA Study Report is prepared; the implemented savings and benefits are reported to headquarters.

The VA study is complete when the VA alternatives have been evaluated, dispositions have been made, the project documents have been revised, and the implemented savings have been reported.

The following VA Study Agenda and VA Meeting Attendees sheet document the schedule and participants for the VA Study reported here.

VA STUDY AGENDA

July 28: Day 1

(8:00 AM to 5:00 PM)

- Opening Comments
- Introductions, Purpose and Schedule
- Project Overview and Information Review – Caltrans Project Management
- Site Visit, Cost Models, and Documents Review

July 29: Day 2

(8:00 AM to 5:00 PM)

- Function Analysis
- FAST Model
- Creation of Ideas

July 30: Day 3

(8:00 AM to 5:00 PM)

- Creation of Ideas
- Evaluation of Ideas

August 11: Day 4

(8:00 AM to 5:00 PM)

- Alternative Development and Documentation

August 12: Day 5

(8:00 AM to 5:00 PM)

- Alternative Development and Documentation

August 13: Day 6

(8:00 AM to 3:00 PM)

- Team Presentation to Management
- Closing Comments

VALUE ANALYSIS STUDY PARTICIPANTS

The VA team was organized to provide specific expertise on the unique project elements involved. Team members consisted of a multi-disciplined group with professional design experience on this type of project.

The six-day study was performed during the period of July 28-30 and August 11-13, 1998, at Caltrans District 4 Headquarters in Oakland, California. The VA study was led by George Hunter from Caltrans VA Branch and Roger Sperling, CVS, from TVI International. The VA team members are listed below:

George Hunter	Team Leader	Caltrans Headquarters
Roger Sperling	Assistant Team Leader	TVI International
N. Dean Marachi	Geotechnical	The Mark Group
Heidi Ouren	Highway Design	HQE
Paul Ward	Constructibility	Project Management
Martin Pohll	Structures Design	Caltrans – Structures Design
Jack Kwei	Bridge Construction	Caltrans – Structures
Roberto Luena	Construction	Caltrans - Structures
Rob Shackelford	Construction	Caltrans – Structures
Ed Der	Construction	Caltrans – District 4
Fred Elenbaas	Highway Design	Caltrans – District 4

Throughout the VA session, the VA team was supported by several members of Caltrans District 4, the stakeholders, and the design team. These participants included:

Hamid Khorram	VA Coordinator	Caltrans – Design
Albert Wong	Traffic Engineer	City of San Francisco
Renata Frey	Right-of-Way	Caltrans
Jared Goldfink	Environmental Planning	Caltrans
Robert Zezoff	Project Manager, Retrofit/Widening	Caltrans – Structures Design
Bijan Sartipi	Project Manager, SF-101 Central	Caltrans – Design Peninsula
Gersy Modesto	Project Engineer	Caltrans – Design Peninsula
Stuart Goodson	Transportation Engineer	Caltrans – Design West
Duat Nguyen	Senior Transportation Engineer	Design Peninsula
Nancy Bobb	Bridge Engineer	FHWA
Martha Nevai	Bridge Engineer	FHWA
Chris Zdunkiewiz	Environmental	Caltrans
Dennis Bosler	Project Manager	Caltrans

MEETING ATTENDEES						Caltrans						
Project Name: *SF-101 Central Viaduct Replacement*						**Meeting Location:** Caltrans District 4 - Oakland						
July			**August**			**NAME**	**ORGANIZATION**	**POSITION**	**TELEPHONE**		**FAX**	
28	**29**	**30**	**11**	**12**	**13**							
F	F	F	F	F	F	George Hunter	Caltrans Headquarters	Team Leader	916	653-3538	916	653-2124
F	F	F	F	F	F	Roger Sperling	TVI International	Assistant Team Leader	925	210-0259	925	210-1959
P	P	P	P	P	P	Hamid Khorram	Caltrans – Design Coordination	VA Coordinator	510	286-4995	510	286-5229
F	F	F	F	F	F	Heidi Ouren	HQE	Highway Design	925	934-6932	925	934-6933
F	F	F	F	F	F	Paul Ward	Project Management	Constructibility	510	286-5333		
F	F	F	F	F	F	Ed Der	Caltrans – District 4	Construction	415	557-7050	415	557-7678
F	F	F	F	F	F	N. Dean Marachi	The Mark Group	Geotechnical	925	685-6275	925	685-2380
P	P	P	P	P	P	Robert Zezoff	Caltrans – Structures Design	Project Manager —Retrofit & Widening	916	227-8892	916	227-8379
F	F	F	F	F	F	Martin Pohll	Caltrans – Structures Design	Structures Design	916	227-8741	916	227-8379
F	F	F	F	F	F	Roberto Luena	Caltrans District 4	Construction	415	557-7673		
F	F	F	F	F	F	Jack Kwei	Caltrans – Structures	Bridge Construction	415	557-1299	415	557-7678
F	F	F	F	F	F	Fred Elenbaas	Caltrans District 4	Design	510	286-6027		
F	F	F	F	F	F	Albert Wong	City of San Francisco	Traffic	415	554-2331		
F	F	F	F	F	F	Chris Zdunkiewiz	Caltrans	Environmental	510	286-4194		

F = Full-Time, P = Part-Time

BLANK FORMS

- VA Report Checklist
- Value Analysis Alternative
- Sketches
- Calculations
- Benefits
- Initial Costs
- Life Cycle Costs
- VA Design Suggestion
- Study Identification
- Cost Model – Pareto Chart
- Function Analysis
- FAST Diagram
- Cost-Function Worksheet
- Evaluative Criteria Matrix
- Weighted Comparison Matrix
- Creative Ideas Evaluation
- Summary of Alternatives
- VA Study Agenda
  - 4-Day Agenda
  - 5-Day Agenda
  - 6-Day Agenda
- Meeting Attendees
- Management Presentation Comments
- VA Alternative Implementation
- VA Database Input

VA REPORT CHECKLIST

The following checklist is to guide the VA team leader through all of the items contained in the VA study report. It is organized in the order of the printed report. However, it is helpful to complete the items in reverse order so that the Executive Summary is written last, after the balance of the report is completed.

Report Front Material

- ☩ Contents
- ☩ Front Cover, Edge and Back Cover
- ☩ Divider Tabs
- ☩ Cover Letter
- ☩ Distribution List

Executive Summary (Section 1)

- ☩ Abstract
- ☩ Introduction with EA Number(s)
- ☩ Project Description Summary
- ☩ Concerns and Objectives
- ☩ Project Analysis Summary
- ☩ Key VA Alternatives
- ☩ Implementation Action
- ☩ Management Presentation Comments
- ☩ VA Team and Process Summary

Implementation Action (Section 2)

- ☩ Report Text
- ☩ Summary and Disposition Sheets
- ☩ VA Alternative Implementation Sheets

VA Alternatives (Section 3)

- ☩ Report Text
- ☩ VA Alternatives Documentation
- ☩ VA Design Suggestion Documentation

Project Analysis (Section 4)

- ☩ Report Text
- ☩ Cost Models
- ☩ Function Analysis
- ☩ FAST Diagram
- ☩ Cost-Function Analysis
- ☩ Paired Comparison Matrix
- ☩ Weighted Evaluation Matrix
- ☩ Life Cycle Benefit-Cost Analysis

Project Description (Section 5)

- ☩ Introduction
- ☩ Project Description
- ☩ Information List
- ☩ Key Drawings
- ☩ Project Information

Idea Evaluation (Section 6)

- ☩ Report Text
- ☩ Creative Idea and Evaluation Worksheets

Value Analysis Process (Section 7)

- ☩ Report Text
- ☩ Study Agenda
- ☩ Study Participants List
- ☩ Meeting Attendees

VALUE ANALYSIS ALTERNATIVE *Project Name*	Caltrans	
FUNCTION:	**IDEA NO.**	**ALTERNATIVE NO.**
TITLE:		**PAGE NO.** 1 of

ORIGINAL CONCEPT:

ALTERNATIVE CONCEPT:

ADVANTAGES:

-

DISADVANTAGES:

-

DISCUSSION / JUSTIFICATION:

IMPLEMENTATION PLAN:

COST SUMMARY	Initial Cost	Present Value Subsequent Cost	Present Value Highway User Cost	Net Present Value
Original Concept	**$**	**$**	**$**	**$**
Alternative Concept	**$**	**$**	**$**	**$**
Savings	**$**	**$**	**$**	**$**

Team Member:	Discipline:	Telephone:

SKETCHES ***Project Name***	**Caltrans**	
TITLE:	**NUMBER**	**PAGE NO.** of

CALCULATIONS ***Project Name***	**Caltrans**	
TITLE:	**NUMBER**	**PAGE NO.** of

BENEFITS ***Project Name***	**Caltrans**	
TITLE:	**NUMBER**	**PAGE NO.** of

SCHEDULE IMPROVEMENTS:

SAFETY IMPROVEMENTS:

TRAFFIC OPERATIONS:

ISSUE RESOLUTION:

STAKEHOLDER/PARTNER CONSENSUS:

OTHER BENEFITS:

INITIAL COSTS *Project Name*							Caltrans
TITLE:						**ALT. NO.**	**PAGE NO.** of
CONSTRUCTION ELEMENT		**ORIGINAL CONCEPT**			**ALTERNATIVE CONCEPT**		
Description	**Unit**	**Quantity**	**Cost/Unit**	**Total**	**Quantity**	**Cost/Unit**	**Total**
ROADWAY ITEMS							
ROADWAY SUBTOTAL							
ROADWAY MARK-UP	*%*						
ROADWAY TOTAL							
STRUCTURE ITEMS							
STRUCTURE SUBTOTAL							
STRUCTURE MARK-UP	*%*						
STRUCTURE TOTAL							
RIGHT-OF-WAY ITEMS							
Right-of-Way Acquisition							
Utility Relocation							
Relocation Assistance							
Demolition							
Title and Escrow Fees							
RIGHT-OF-WAY TOTAL							
ENVIRONMENTAL MITIGATION ITEMS							
CAPITAL OUTLAY SUPPORT ITEMS							
Reengineering and Redesign							
Project Engineering							
TOTAL							
						SAVINGS	

LIFE CYCLE COSTS *Project Name*				Caltrans	
TITLE:				**ALT. NUMBER**	**PAGE NO.**
Life Cycle Period _____ Years	Real Discount Rate _____ %			**ORIGINAL**	**ALTERNATIVE**
A. INITIAL COST					
Service Life-Original _____ Years Service Life-Alternative _____ Years			**INITIAL COST SAVINGS:**		$0
B. SUBSEQUENT ANNUAL COSTS					
1. Maintenance and Inspection					
2. Operating					
3. Energy					
			Total Subsequent Annual Costs:	$0	$0
			Present Value Factor (P/A):		
			PRESENT VALUE OF SUBSEQUENT ANNUAL COSTS:	$0	$0
C. SUBSEQUENT SINGLE COSTS	**Year**	**Amount**	**PV Factor (P/F)**	**Present Value**	**Present Value**
Rehabilitations - Original				$0	
Rehabilitations - Alternative					$0
Repairs - Original				$0	
Repairs - Alternative					$0
Expended Service Life - Original				$0	
Expended Service Life - Alternative					$0
Salvage - Original				$0	
Salvage - Alternative					$0
			PRESENT VALUE OF SUBSEQUENT SINGLE COSTS:	$0	$0
D. TOTAL SUBSEQUENT ANNUAL AND SINGLE COSTS (B+C)				$0	$0
E. HIGHWAY USER ANNUAL COSTS				**Present Value**	**Present Value**
1. Accident				$0	$0
2. Travel Time				$0	$0
3. Vehicle Operating				$0	$0
			TOTAL HIGHWAY USER ANNUAL COSTS:	$0	$0
F. TOTAL PRESENT VALUE COST (A+D+E)				$0	$0
				TOTAL LIFE CYCLE SAVINGS:	$0

VALUE ANALYSIS DESIGN SUGGESTION *Project Name*	**Caltrans**	
FUNCTION:	**NUMBER**	**PAGE NO.** 1 of
TITLE:		

ORIGINAL CONCEPT:

ALTERNATIVE CONCEPT:

ADVANTAGES:

-

DISADVANTAGES:

-

DISCUSSION / JUSTIFICATION:

IMPLEMENTATION PLAN:

Team Member:	**Discipline:**	**Telephone:**

STUDY IDENTIFICATION *Project Name*				Caltrans		
PROJECT LOCATION				**STUDY DATES**		
ROUTE	**PM (KP)**	**CHARGING INFORMATION**	**EA**	**FA**	**AO**	**MSA**

VA TEAM MEMBERS			
NAME	**TITLE**	**ORGANIZATION**	**PHONE / FAX**

PROJECT DESCRIPTION		
LENGTH	**COST**	**TYPE OF FUNDS**

PROJECT PHASE/PROJECT MILESTONE
MAJOR PROJECT ELEMENTS

DESIGN SPEED	**PROJECTED TRAFFIC** **ADT** **DHV**	**PROJECTED AWARD DATE**

ROUTE CONDITIONS	
ADJACENT SEGMENTS	**OVERALL ROUTE**

COST MODEL *Project Name*		Caltrans
COST SUMMARY		
Item	**Cost**	**Percent**

PARETO CHART	
COST SUMMARY	
Item	**Cost ($_____)**

FUNCTION ANALYSIS *Project Name*							Caltrans
PROJECT:							**Page** of
No.	**Description**	**Function**			**Cost**	**Worth**	**Comments**
		Verb	**Noun**	**Kind**			

Function: **Active Verb** **Measurable Noun**

Kind: **B** = **Basic** **S** = **Secondary** **RS** = **Required Secondary** **HO** = **Higher Order** **A** = **Assumed** **U** = **Unwanted**

FAST DIAGRAM *Project Name*	**Caltrans**

How? →

When? ↕

← **Why?**

COST/FUNCTION ANALYSIS *Project Name*								Caltrans		
Item	**Est. Cost ($)**									
TOTAL										
%										

EVALUATIVE CRITERIA MATRIX

Project Name

Caltrans

												TOTAL	%
A													
B													
C													
D													
E													
F													
G													
H													
I													
J													
K													
L													

a	More Important
a/b	Equal Importance

WEIGHTED COMPARISON MATRIX

Project Name

Caltrans

Evaluative Criteria	Weight of Importance	Base		Alternative 1		Alternative 2		Alternative 3		Alternative 4	
		Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
Total Weighted Criteria	**100**										
Estimated Cost ($ Million)											
Value Ratio = Criteria/Cost											
Estimated LCC ($ Million)											
Value Ratio = Criteria/LCC											

CREATIVE IDEAS EVALUATION *Project Name*								Caltrans	
		Criteria					Advantages	Disadvantages	Rank
No.	FUNCTION								

Ranking Scale:	**10-7 = Most Likely to be Developed**	**6 = Design Suggestion**	**1-5 = Least likely to be developed**
Evaluation Criteria:	**Significant Improvement +2, +1, 0, -1, -2 Significant Degradation**		

SUMMARY OF VA ALTERNATIVES *Project Name*					Caltrans
Value Analysis Alternatives					
Alternative Number	**Name**	**Potential Savings**	**Implemented Savings**	**Disposition**	**Comments**

A = Accepted **CA = Conditionally Accepted** **R = Rejected**

VA Study Agenda – 4 Days

Day 1

(8:00 AM to 5:00 PM)

- Opening Comments
- Introductions, Purpose and Schedule
- Project Overview and Information Review
- Site Visit

Day 2

(8:00 AM to 5:00 PM)

- Function Analysis
- FAST Diagram
- Creativity
- Evaluation

Day 3

(8:00 AM to 5:00 PM)

- Alternative Development and Documentation

Day 4

(8:00 AM to 4:00 PM)

- Alternative Development and Documentation
- Team Presentation to Management
- Closing Comments

VA Study Agenda – 5 Days

Day 1

(8:00 AM to 5:00 PM)

- Opening Comments
- Introductions, Purpose and Schedule
- Project Overview and Information Review
- Site Visit

Day 2

(8:00 AM to 5:00 PM)

- Function Analysis
- FAST Diagram
- Creativity
- Evaluation

Day 3

(8:00 AM to 5:00 PM)

- Evaluation
- Alternative Development and Documentation

Day 4

(8:00 AM to 5:00 PM)

- Alternative Development and Documentation

Day 5

(8:00 AM to 3:00 PM)

- Alternative Development and Documentation
- Team Presentation to Management
- Closing Comments

VA Study Agenda – 6 Days

Day 1

(8:00 AM to 5:00 PM)

- Opening Comments
- Introductions, Purpose and Schedule
- Project Overview and Information Review
- Site Visit

Day 2

(8:00 AM to 5:00 PM)

- Function Analysis
- FAST Diagram
- Creativity

Day 3

(8:00 AM to 5:00 PM)

- Evaluation
- Assignment of Alternatives

Interval

- A two- to seven-day break to allow team members to engage in individual analysis and to perform other activities.

Day 4

(8:00 AM to 5:00 PM)

- Review Evaluated Ideas and Alternative Assignments
- Alternative Development and Documentation

Day 5

(8:00 AM to 5:00 PM)

- Alternative Development and Documentation

Day 6

(8:00 AM to 3:00 PM)

- Alternative Development and Documentation
- Team Presentation to Management
- Closing Comments

MEETING ATTENDEES								Caltrans				
Project Name:								**Meeting Location:**				
						NAME	**ORGANIZATION**	**POSITION**	**TELEPHONE**		**FAX**	

F = Full-Time, P = Part-Time

MANAGEMENT PRESENTATION COMMENTS *Project Name*			Caltrans
LOCATION:		**DATE:**	**PAGE:** of
Number	**Title**	**Name**	**Comments**

VA ALTERNATIVE IMPLEMENTATION ***Project Name***	**Caltrans**
Title:	**Alt. Number:**
STAKEHOLDER RESPONSES	**DISPOSITION**
Technical Feasibility:	☐ **Accept** ☐ **Conditionally Accept** ☐ **Reject**
Implementable Portions:	**Implemented Savings:**
Validated Cost Savings:	**Stakeholders:** **Project Development Team:** _____ **VA Coordinator:** _____ **VA Team Leader:** _____ **Other:** _____ _____ _____ _____ _____
Schedule Impact:.	
Safety Impact:	
Traffic Operations Impact:	
Issue Resolution:	
Stakeholder/Partner Consensus:	**Approved by:**
Other Benefits:	**Date:**

VA DATABASE INPUT	Caltrans

This form is being developed for use by the VA Team Leader to input data on the VA study project and the individual VA alternatives into the Caltrans VA Database. Electronic files are transmitted to Headquarters VA Branch to capture the following data:

- Pre-study Preparation
  - Project Identifiers
- Study Performance
  - Summaries of all VA alternatives
- Post-Study Implementation
  - Summary of Implementation Actions